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THE PILOT FOOD PRICE SUBSIDY SCHEME IN THE PHILIPPINES: ITS IMPACT ON INCOME, FOOD CONSUMPTION, AND NUTRITIONAL STATUS

Marito Garcia
Per Pinstrup-Andersen

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CONTENTS

Foreword

1. Summary 9

2. The Pilot Food Price Subsidy Scheme 12

3. The Study Areas 17

4. Assessment of Implementation 23

5. Analytical Methodology 27

6. Descriptive Analysis of Income, Consumption, and Nutritional Patterns 38

7. A Comparative Analysis of the Effects of the Food Price Subsidy Scheme 52

8. A Multivariate Analysis of the Effects of the Food Subsidy Scheme 62

9. Cost-Effectiveness Analysis 70

10. Conclusions 78

Appendix: Supplementary Tables 80

Bibliography 90

TABLES

1. Price discounts on rice and cooking oil and their share of the retail price, 1983/84 16
2. Study areas of the Philippine pilot food price subsidy scheme 19
3. Characteristics of sample households compared with the rest of the Philippines 21
4. Experimental design of the pilot food price subsidy study 29
5. Overview of the cost-effectiveness measures used in this study 35
6. Average incomes and income sources by province, survey round, occupation, and income quartile 39
7. Percent of total household expenditures on major commodity groups, by province, survey round, occupation, and income class, 1983-84 40
8. Proportion of the food budget allocated to various foods, by province, survey round, occupation, and income group, 1983-84 42
9. Diet composition by food groups, survey round, occupation, and income group, 1983-84 44
10. Calorie acquisition by food groups, survey round, occupation, and income group, 1983-84 46
11. Calorie intakes of groups of individual household members 48
12. Nutritional status of preschool children, 1983-84 51
13. Weekly food expenditures for each subsample and survey round, 1983-84 53
14. Change in household food expenditures due to price subsidy or nutrition education 53
15. Daily calorie acquisition for each subsample and survey round 54
16. Change in daily calorie acquisition due to price subsidy or nutrition education 54
17. Daily household calorie consumption for each subsample and survey round 55
18. Change in daily household calorie consumption due to price subsidy or nutrition education 56
19. Individual calorie adequacy by age and gender for each subsample and survey round 57
20. Change in calorie adequacy for selected groups of individuals due to price subsidy or nutrition education 58
21. Mean weight-for-age of all preschoolers for each subsample and survey round 60
22. Change in weight-for-age of preschoolers due to price subsidy or nutrition education 60
23. Mean height-for-age of all preschoolers for each subsample and survey round 61

24. Change in height-for-age of preschoolers due to price subsidy or nutrition education 61

25. Key coefficients for household food expenditure and food acquisition regressions 63

26. Parameters for estimating the impact of the pilot subsidy scheme on household food expenditures and calorie acquisition 64

27. Key coefficients and parameters for estimating the impact of the pilot subsidy scheme on the acquisition of rice, maize, oil, and fish 67

28. Regressions of calorie intake of children aged 13 to 83 months 68

29. Key coefficients for nutritional status regressions 69

30. Fiscal costs of the pilot food price subsidy scheme and their distribution 71

31. Estimated net impact of the pilot subsidy scheme on food acquisition and nutrition 72

32. Cost-effectiveness indicators 73

33. Cost-effectiveness comparison with other programs 76

34. Regression results for household food expenditures and food acquisition 80

35. Regression results for acquisition of rice, maize, oil, and fish 81

36. Regression results for calorie intake of children aged 13 to 83 months 82

37. Regression results for weight of children aged 13 to 83 months 83

38. Regression results for weight as a percent of standard weight-for-age, children aged 13 to 83 months 84

39. Regression results for height as a percent of standard height-for-age, children aged 13 to 83 months 86

40. Regression results for z-scores for weight-for-age, children aged 13 to 83 months 87

41. Regression results for z-scores for weight-for-height, children aged 13 to 83 months 88

ILLUSTRATIONS

1. Pilot food discount project delivery system 13
2. Map of the Philippines indicating study areas 18
3. Simplified version of the conceptual model underlying the analyses 27
4. Conceptual model underlying the multivariate analyses 30

FOREWORD

Food costs represent more than 80 percent of total expenditure for the poorest families in developing countries and are a significant budget item even for upper- and middle-income people. Hence, the provision of food subsidies as a means of income distribution in developing countries has had a strong attraction for policymakers. Subsidy costs compose as much as 15 to 20 percent of national budgets, providing important trade-offs among inflation rates, exchange rates, food subsidies, other types of income distribution measures, and development expenditures, which raise incomes in the longer run. In view of this, the International Food Policy Research Institute has, right from its inception, included studies of food subsidy schemes as a major part of its program.

If government expenditure on food subsidies is to be reduced, it is immensely important to know who the beneficiaries of food subsidies are, particularly regarding rural-urban distribution and the distribution among various income groups. There is considerable interest in the impact of various targeting schemes designed to ensure that a high proportion of the benefits go to lower-income people.

The research for this report by Marito Garcia and Per Pinstrup-Andersen was conducted in the Philippines in collaboration with the National Nutrition Council of the Philippines. It was financed by the United Nations Development Programme, the Government of the Philippines, and the U.S. Agency for International Development.

The particular focus of the study is the targeting of food subsidies to the poor by directing subsidies to regions with particularly high proportions of low-income people. Because administrative costs represent a large share of the cost of targeting, devices such as targeting by location help reduce these costs.

In keeping with the tradition of such studies at IFPRI, a carefully drawn sample of households is analyzed in detail to determine the impact of food subsidies. The study is designed to permit an analysis of the cost of the delivery system, and comparisons are made between this and other means of targeting. The results should be useful not only in the Philippines but in other countries that are contemplating means of reducing the cost and increasing the effectiveness of measures to increase the food consumption of low-income people. The study also analyzes the interaction of nutrition education with food subsidies, finding that nutrition education is much more valuable in conjunction with increased food consumption. This information should be useful in a developmental as well as a distributional context.

Although this study does not analyze the returns to expenditure on food subsidies if those returns have been spent in some other way, it provides a basis for such an examination by presenting comparative cost figures.

John W. Mellor

August 1987
Washington, D.C.

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This consumer food subsidy experiment would not have been possible without the support and cooperation of the Philippine National Nutrition Council (NNC) and its director, Delfina B. Aguillon, to whom we are grateful for continuous support throughout the study. The massive day-to-day logistical problems of running this pilot program fell squarely on the shoulders of the field personnel of NNC and the Ministry of Agriculture, who did an outstanding job. In particular, the home management technicians in the provinces of Abra, Antique, and South Cotabato were instrumental in the monitoring of the sample households and making sure that designated shops were open to sell rice and cooking oil at subsidized prices. They, too, were competent interviewers for the four consumption and socioeconomic surveys that were conducted as part of the study.

We gratefully acknowledge the assistance of the Nutrition Foundation of the Philippines and the Food and Nutrition Research Institute in training our survey teams. Melba Aligaen provided excellent organization of the supervisory and field survey teams along with Benilda Labayog, who was seconded to the project from the Bureau of Agricultural Extension. Minda Caedo was a great help in the initial design of the logistics of the subsidy experiment.

This report benefited from the valuable comments and suggestions from many colleagues including John W. Mellor, Jere Behrman, Harold Alderman, Joachim von Braun, Eileen Kennedy, and Gunvant Desai. We are also indebted to Elizabeth Jacinto and Fe Lisondra, who provided excellent computing assistance.

Finally, we wish to thank the United Nations Development Programme, the Government of the Philippines, and the U.S. Agency for International Development Mission in Manila, all of whom provided financial support for this research.

1

SUMMARY

This report presents the results of a pilot targeted food price subsidy scheme implemented in three provinces of the Philippines for 12 months beginning in mid-1983. It assesses the economic and nutritional effects of the scheme, analyzes its technical and administrative feasibility, and considers possible alternatives.

The scheme consisted of price discounts on rice and cooking oil and a nutrition education component. It was made available to half of 14 villages selected for their high incidence of malnutrition and poverty. The other half acted as a control population. Because targeting was geographical, all households in villages selected to receive the discount were eligible. Each household was issued a ration card indicating its monthly quota of rice and oil, based on family size. The rice ration subject to a price discount was only about half the amount usually consumed by most of the households, but the oil ration exceeded the amount usually purchased prior to the subsidy. Thus, consumer rice prices were not reduced at the margin, but oil prices were.

To evaluate its effects, one-third of the households from the selected villages were surveyed. Both comparative and multivariate analyses were made to estimate the impact of the scheme and its components on household food expenditures, acquisition, and consumption. Effects on consumption by preschoolers and their nutritional status were also monitored. Data on a variety of socioeconomic, environmental, and biological variables relating to food consumption and nutrition were collected before, during, and after the scheme. Two alternative methods were used to collect data on household food consumption. In the food acquisition method, called flexible period recall, all foods obtained by family members for a week were recorded. Under the food consumption method, all food consumed by household members was weighed for a 24-hour period. Food consumption by individual preschoolers was estimated on the basis of 24-hour food weighing for a subsample of the survey households.

The average monthly income of the sample households was 910 pesos, which is substantially lower than the Philippine average. Total expenditures of the sample households were 84 percent of total incomes, on average. The poorest showed a dissaving, while those who were better off were able to save significant amounts.

Although the total sample was drawn from agricultural and fishing villages in rural areas, only about one-third of the incomes originated directly from farming and fishing; almost one-half came from salaries and wages. Food accounted for 79 percent of total expenditures of the poorest quartile and 71 percent, on average, for the sample as a whole.

About 40 percent of the average food budget was spent on rice. Food expenditure patterns and diet composition differed considerably among occupational and income groups, with the poorest obtaining a larger share of calories from rice and maize. Average daily calorie consumption per adult equivalent unit (AEU) was 1,700 calories when based on 24-hour food weighing and 1,837 calories when based on flexible period recall. The 7 percent difference is explained primarily by the exclusion of weekends from food weighing.

Individual food consumption data collected from a subsample of 140 households indicate that the distribution of food within the households was biased in favor of adults. The calorie adequacy rate is estimated to be about 0.80 for adults, 0.60 for male preschoolers, and 0.55 for female preschoolers. School-age children and pregnant and lactating women also had low calorie adequacy rates.

The average weight of the sample preschoolers was about 83 percent of the standard weight-for-age. About one-fourth of the preschoolers were malnourished (less than 75 percent of the standard). Although most of the sample households were poor, the extent of malnutrition varied considerably among occupational groups. Forty percent of the preschoolers of hired fishermen were malnourished compared with 15 percent for professionals and salary earners. As income increased, malnutrition decreased, ranging from 30 percent among the poorest quartile to 16 percent among the richest.

According to the comparative analyses, the subsidy component of the scheme caused an increase in household food expenditures and calories acquired and consumed, as well as in calories consumed by most individual household members. Although adults obtained the largest share, the average weight of preschoolers also increased.

The second component of the scheme—nutrition education—had a small positive effect in households where it was accompanied by the subsidy. When education was provided without additional purchasing power, however, no effect could be detected. But the subsidy without the education component was still effective.

Multivariate analysis confirms and further refines these findings. The impact of the price subsidies on household food expenditures and acquisition was highly significant. Increased purchasing power, lower oil prices, and the subsidy itself all contributed.

The income elasticities of total food expenditures and total calorie acquisition indicate that a 10 percent increase in household incomes could result in a 7 percent increase in food expenditures and a 3 percent increase in calorie acquisition. Each additional peso of income from sources other than the subsidies is estimated to expand daily calorie acquisition by about 150 calories per AEU. However, an additional peso of purchasing power of food subsidies is estimated to result in an increase of about 230 calories. These findings indicate that consumers are more likely to increase their food consumption if foods are subsidized than if incomes are raised directly.

When multivariate analysis is employed, the nutrition education component of the scheme shows no significant impact on household food expenditures and acquisition, but food consumption and the nutritional status of preschoolers are strongly affected, indicating that the nutrition messages increased the focus on children.

Estimation of the effects of the scheme on the nutritional status of preschoolers is based on five indicators: weight; weight as a percent of standard weight-for-age; the z-score (a method of standardizing distribution) of weight-for-age; the z-score of weight-for-height; and height as a percent of standard height-for-age. The nutritional status of preschoolers was most affected by household incomes and calorie consumption—variables influenced by the subsidies.

The evidence indicates that the subsidy had positive effects on both households and preschoolers. The scheme resulted in net increases in household calorie acquisition of 136-138 calories per AEU per day, which is about 7 percent of current calorie consumption; in calorie consumption by preschoolers of 31-55 calories per child per day (4-6 percent of current consumption); and in the weight of preschoolers of 0.12-0.14 kilograms.

Eighty-four percent of the cost of the scheme was the subsidy itself. Administrative costs accounted for about 9 percent and the incentive payment to retailers to assure efficient distribution of subsidized food was about 7 percent. The fiscal cost of each $1.00 transferred to participating households was $1.19 in U.S. dollars. However, if only transfers to households with malnourished preschoolers are considered a benefit, the cost increases to $3.61. Similarly, the annual cost of a net increase in calorie consumption of 100 calories per AEU per day among all households is estimated to be $6.75 per AEU. The amount increases to $13.66 if only the food received by households with malnourished preschoolers is considered.

The annual cost of eliminating calorie deficiencies in the study population is estimated to be $25 per AEU. Adding 1 kilogram to the weight of each preschooler would cost $24 per year. If only weight gains among the malnourished are counted as benefits, the cost would increase to $56.

In comparison with other food and nutrition programs, the scheme's cost-effectiveness is favorable. Costs were low because, first, geographical targeting based on growth monitoring costs less than targeting based on household income levels; second, the use of existing private-sector retail outlets for the distribution of subsidized foods costs less than a separate distribution network; and third, the use and expansion of existing local bureaucratic structures cost less than the creation of a new and independent structure.

If the sole goal of such a scheme is to expand food consumption by households with malnourished preschoolers and to improve the nutritional status of these preschoolers, its cost-effectiveness could be significantly improved by additional targeting based on growth monitoring. However, the calorie adequacy rates of school-age children were almost as low, which casts doubt on the wisdom of targeting to one group of children alone.

Finally, the study finds a strong relationship between malnutrition and poverty. Groups such as landless farm workers and tenant farmers are most likely to be malnourished because of their limited purchasing power.

2

THE PILOT FOOD PRICE SUBSIDY SCHEME

Introduction

In 1980 the Philippine Ministry of Agriculture together with the National Nutrition Council and the National Economic Development Authority formulated the Philippine Food and Nutrition Plan (FNP) to provide the framework for action and research in nutrition, food consumption, and food production for the 1980s. The main objectives of the Plan were to increase and diversify the production of food and other agricultural commodities; to improve the quality of the diet of all Filipinos; and to assure a basic minimum diet for the undernourished. These objectives were to be achieved through the following broad strategies: stimulating the growth of the food economy; increasing export earnings and producing import substitutes; maintaining consumer prices at reasonable levels; and undertaking immediate programs to prevent malnutrition and to correct the most serious nutritional deficiencies, particularly calorie deficiency.

A food price discount or subsidy program was one of the immediate and short-term programs identified under the FNP to reduce calorie deficiencies among low-income households.[1] The scheme was conceived as a stop-gap measure aimed at bringing about immediate improvements in the energy intakes of malnourished individuals. Although viewed as a temporary measure, its phase-out was inextricably linked to the success of other elements of the FNP that seek longer-term solutions, such as increasing productivity and incomes of the beneficiaries, which would reduce the need for food subsidies.

The food subsidy scheme evolved out of the recognition that undernutrition cannot be solved effectively without expanding the ability of the poor to acquire food. Although the food production program of the government, particularly for rice, was a success, there were clear indications that these achievements, though important, were not sufficient to bring food consumption and nutritional status of the majority of the poor up to an acceptable level.

Past programs in nutrition have pointed toward direct intervention, such as supplementary feeding, health protection, nutritional rehabilitation, nutrition education, and family planning. Less attention has been focused on programs to improve the accessibility of food, particularly to the more deprived groups. Since 1981, a marketing scheme called KADIWA has been promoted to lower the costs of food in the main urban areas. The level of coverage, however, is low, and the scheme has reached only a small portion of the disadvantaged groups. Although the KADIWA program focuses on food, it has no expressed nutritional objective.

To assess the feasibility of FNP's proposed food subsidy program and to help assure that its design would be cost-effective, a one-year pilot scheme was implemented during 1983-84 in three provinces of the Philippines. The pilot program was specifically designed to permit its evaluation from viewpoints of incomes, nutrition, and technical and administrative feasibility. In addition to periodic surveys of selected households in the areas where the pilot scheme was implemented, data for the economic and nutritional assessments were obtained from extensive monitoring of all parts of the scheme. This report presents findings from the surveys and monitoring.

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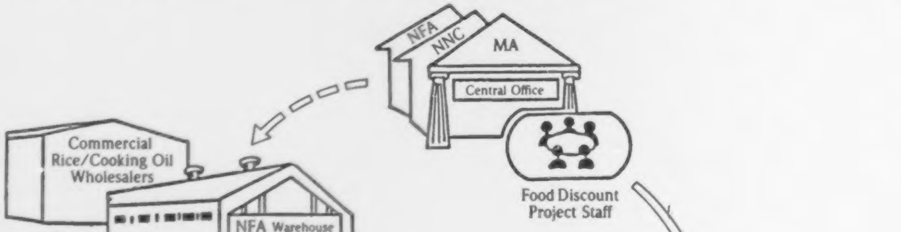
[1] Philippines, Ministry of Agriculture, National Nutrition Council, and National Economic and Development Authority, *The Philippine Food and Nutrition Plan for the 80s* (Manila: Ministry of Agriculture, 1980).

Description of the Pilot Scheme

The principal element of the pilot subsidy scheme was a reduction in the price of rice and edible oil offered for sale in selected areas identified as having high rates of malnutrition.[2] Nutrition education formed another element. Figure 1 is a simplified flowchart of the operation of the pilot food subsidy scheme. Each household in the project area was issued a ration (discount) card, which guaranteed a monthly quota of rice and cooking oil at a subsidized price. Participating families could use the ration card only in the accredited stores and only for the discounted purchase of rice and edible oil. The coded, nontransferable card, which showed the monthly quota of the household based on household size, provided space to record the purchases and signature of the store owner. For each sales transaction, the participating households were required to sign a sales logbook and the retailer was required to sign in a space provided on the ration card. The distribution and certification of the ration cards were handled by the Ministry of Agriculture through its local officers—the home management technicians (HMTs). Cards were valid for a period of one month, and they were issued at the beginning of each month.

Figure 1—Pilot food discount project delivery system


NFA
NNC
MA
Central Office
Commercial Rice/Cooking Oil Wholesalers
(Private)
NFA Warehouse
(Gov't.)
Food Discount Project Staff
Do Not Delay
Delivery Truck
Reimbursement of Discount Value
Rural Bank
Food Discount Project Special Savings Deposit
List of Brgy. Residents
Sales Book
Verify and Monitor Sales
Barangay Store
Purchases
Monitor Purchases
Home Management Technicians
Food Discount Card
Barangay Licensed Grain Retailer (Private)
Target Beneficiaries

Note: NFA is the National Food Administration, NNC is the National Nutrition Council, and MA is the Ministry of Agriculture.

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[2] These areas are described in detail in the next chapter.

The retail distribution outlets chosen for the pilot scheme were the neighborhood variety stores (called *sari-sari* stores) usually located within each village. The advantage of using local neighborhood stores in the scheme was their accessibility to the target beneficiaries. Locating the outlets in the neighborhood is compatible with the food-buying practices of the poor, who often buy food on a day-to-day basis and in small amounts. A study of such practices indicates that, among the very poor, small but frequent purchases are resorted to deliberately to ensure that food will not be consumed at once—a survival technique that allows families to stretch their budgets.[3]

Sari-sari stores are typically small, family-run enterprises that carry food, beverages, household items, tobacco and cigarettes, and other items that are normally sold in public markets. They perform a unique function in the life of the poor because they serve immediate needs of households. Without such outlets, households would have to buy from the nearest market town, which in many cases is far from the village.

Sari-sari stores normally operate with small revolving capital; not all are able to carry large quantities of rice. Under Philippine law, a license from the National Food Authority is necessary for any enterprise to sell grains. Under the pilot scheme, the local office of the Ministry of Agriculture followed a set procedure to select the *sari-sari* stores that would be accredited under the scheme. Among the criteria for selection were accessibility to participating households, size of revolving capital, license to retail grains, and acceptability of the retailer to local community leadership.

The ultimate distribution mechanism under the pilot scheme was left entirely to the private sector. Hence, the *sari-sari* store owner was responsible for the procurement of food commodities, as well as handling and final sales to the participating households. The function of the store owner was to serve all card-carrying participants within his designated area of jurisdiction. The government's role was to monitor the retail prices of subsidized food in the stores, audit their accounts for proper redemption of the subsidies, and reimburse retailers for the difference between the market price of the subsidized food commodity and the designated subsidized program price. The government depended on the services of the HMTs from the local extension office of the Ministry of Agriculture to carry out these tasks.

The *sari-sari* store owners procured subsidized rice and edible oils mostly from commercial sources, but in some instances they were procured from the government-owned National Food Authority. In general, store owners preferred to buy from the commercial sources where they were normally given credit.

The retailers were reimbursed for the subsidy only after the sales transactions were made. In return, the scheme provided an incentive to the retailers of 7 percent of the gross sales of the subsidized commodities. Subsidy accounting, which was done by the extension officer, was computed from the discount cards. These cards were redeemed every month along with the retailers' sales books. The program used local banks to reimburse the participating retailers. A special savings deposit account, which was opened in each area, was jointly held by the program office and the retailer. An accounting form called a discount reimbursement voucher was required for the twice-a-month withdrawal from the bank subsidy account. These vouchers helped the program office keep track of the accounts.

Selection of Food Commodities for the Scheme

The 1982 Second Nationwide Nutrition Survey carried out by the Food and Nutrition Research Institute (FNRI) indicated that the most important nutritional problem in the country was inadequate calorie intake. The average Filipino consumed 200-250 calories[4] below the recommended dietary allowances, and the problem was more severe among low-income groups.[5]

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[3] Simeon G. Silverio, *The Neighborhood Sari-Sari Store,* Institute of Philippine Culture Poverty Series 2 (Quezon City, Philippines: Ateneo de Manila University, 1975).

In the light of these findings, two calorie-rich foods, rice and edible oil, were selected for the program. These foods contribute nearly two-thirds of the calorie consumption of an average Filipino. Rice was selected for the scheme because it is universally available and the preferred staple food in the country, composing 56 percent of the calorie consumption of the average Filipino.

Apart from these nutritional considerations, the use of rice was justified on economic grounds, rice having high income and price elasticities for low-income households.[6] In addition, the marketing system for rice in the Philippines is efficient and reaches even the most widely dispersed populations.

Edible oil from coconuts, on the other hand, is nutritionally important because of its caloric density. This is particularly critical in the case of infants and small children, whose digestive systems may be unable to absorb the necessary energy from diets that are based on a high-bulk food such as rice. FNRI considered the average annual consumption of 2.9 kilograms of vegetable oil per capita inadequate.[7]

The Size of the Subsidies

The amount of rice that target households could obtain under the pilot scheme was smaller than the amount consumed by most but not all households prior to the scheme: that is, it was inframarginal for most households. Under the scheme, each household member irrespective of age was entitled to 5 kilograms of subsidized rice per month. The average rice consumption of the targeted households before the start of the project was about 10 kilograms per capita per month.

The amount of edible oil, 400 grams per month, that each household member could obtain at the discounted price was higher than the average consumed prior to implementation of the scheme. The higher discounted quantity of edible oil reflected a government policy to expand its domestic consumption. The National Nutrition Council saw increasing consumption of edible oil in the diet of Filipinos as a strategy to narrow the calorie gap. FNRI concluded that the current share of oils and fats in the diet was too low, while the potential for its use was considerable because the Philippines is among the world's leading exporters of coconut oil.

The initial price subsidy was 32 percent for rice and 50 percent for cooking oil. These discounts were initially projected to transfer approximately 200-250 calories per person per day—a level that was computed directly from the food consumption elasticities available at the start of the pilot experiment. The initial plan was to maintain these percentage discount rates throughout the study period. In the latter half of the experiment, the last quarter of 1983, domestic consumer rice and oil prices increased abnormally—the rice price rose from 2.90 pesos (P) per kilogram to P 4.25 per kilogram, while the price of cooking oil doubled. Thus it was necessary to reduce the percentage of the retail price to be discounted in order to keep the cost of the scheme within its original budget. Further price increases were followed by a reduction in the percentage of the discount. The price discounts are given in Table 1.

Nutrition Education

The nutrition education component of the scheme was included as a complementary intervention to the price subsidy. The form of nutrition education adopted closely followed that used under the Philippine Nu-

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[4] All calories referred to in this report are kilocalories.

[5] Philippines, Food and Nutrition Research Institute, National Science and Technology Authority, *Second Nationwide Nutrition Survey, Philippines 1982* (Manila: NSTA, 1984).

[6] Howarth Bouis, "Rice Policy in the Philippines" (Ph.D. dissertation, Stanford University, 1982).

[7] Ibid.

Table 1—Price discounts on rice and cooking oil and their share of the retail price, 1983/84

Period	Price Discount as a Percent of Retail Price		Price Discount	
	Rice	Cooking Oil	Rice	Cooking Oil
			(pesos/person/month)	
July – August 1983	32	50	4.95	2.25
September 1983 – April 1984	29	45	4.90	2.25
May – June 1984	21	23	5.10	2.60
July 1984	19	22	5.15	2.60

Source: Based on data collected by the International Food Policy Research Institute, Philippines National Nutrition Council, and the Philippines Ministry of Agriculture, "Pilot Food Subsidy Survey, 1983/84," Philippines.
Note: The exchange rate in 1983/84 was U.S. $1.00 to P19.

trition Program, which had been in existence for 10 years at the time of the study. The method consisted of face-to-face extension education supplemented by handout materials for information dissemination.

The nutrition education in this scheme was aimed at changing behavior relating to food consumption, first, to encourage optimal use of the additional oil from the scheme; second, to ensure that food consumption and nutritional benefits would be realized from the rice and cooking oil subsidy; and third, to improve child feeding practices. The first two items were specific to the project scheme, while the third is standard in all of the nutrition education messages in the Philippine Nutrition Program. In this respect, the scheme's nutrition education messages and the desired behavioral changes differed from regular nutrition education in that nutrition education was used as a complement to, rather than as a substitute for, the subsidies.

Mothers, the primary audience of the nutrition education scheme, regularly attended mothers' classes. Outreach was high: only 15 percent of mothers in the study villages did not regularly participate. In households where cases of second- and third-degree malnutrition were identified, extension workers made monthly home visits.

The field workers used as educators in the scheme consisted of the HMTs of the Ministry of Agriculture supported by local paraprofessional volunteers, known as *barangay* nutrition scholars (BNS). All field workers had prior experience in nutrition education methods. Retraining of these workers for the pilot scheme emphasized the nutrition education messages. The central staff of the project monitored the scheme to attain uniformity in methods and messages across all of the treatment villages, to ensure that classes would be consistent, and to maximize attendance by mothers.

3

THE STUDY AREAS

Criteria for Site Selection

The pilot areas were selected from economically depressed provinces. Although no attempt was made to select a sample of areas representative of the country as a whole, the three provinces chosen were drawn from each of the three main geographical groupings: Luzon, Visayas, and Mindanao. The three provinces were Abra, located in the northern Philippines; Antique in the central part; and Cotabato in the south (see Figure 2). Four villages were selected from each of the three provinces. The rice and oil subsidies were implemented in two villages, and the other two were used as control (comparison) areas. In each of the provinces, nutrition education was introduced in one of the two subsidy villages and in one of the two control villages. In one of the provinces (Antique), two additional villages were selected to test the impact of a scheme using edible oil as the only subsidized commodity, with and without education. The number of the study villages was, therefore, 14. This sample size was largely dictated by research costs and the ability to maintain an acceptable level of control over experimental conditions, and it represents an incomplete experimental design in that not all combinations of treatment and controls were included. In selecting the villages, representation of the dominant socioeconomic and ecological environments in the country was considered, as well as the nutritional situation of the village's children, based on the anthropometric reports of the National Nutrition Council. The treatment and comparison villages within each province were chosen for maximum comparability in economic base, topography, demography, ethnic origin, infrastructure services, and other socioeconomic characteristics.

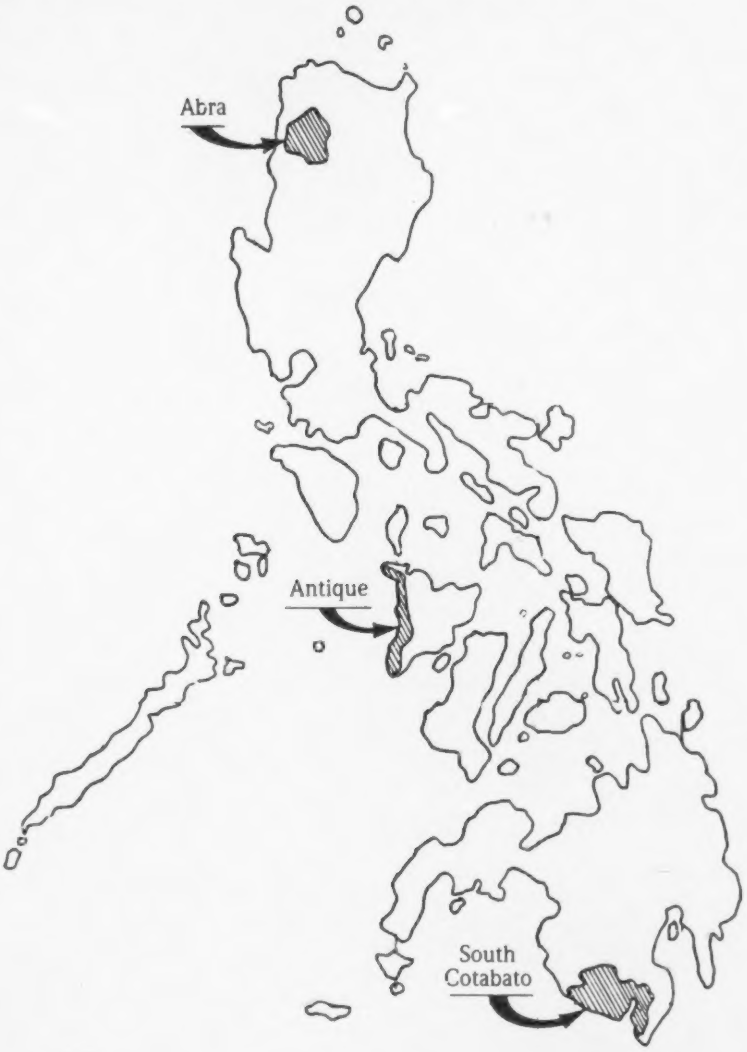
It should be noted that because an aim of the pilot scheme was also to test its administrative feasibility, the pilot areas were chosen to include a variety of infrastructural and extension service conditions. Hence, areas with both adequate and inadequate extension services and distribution outlets were represented.

As can be seen from the summary of characteristics of the pilot areas in Table 2, the various types of socioeconomic and ecological environments covered include upland, lowland, and coastal areas, and areas whose economic base varies, such as maize, rice, and coconut farming, fishing, handicrafts, and other indigenous industries.

Characteristics of Study Areas

The first group of study villages is located in the province of Abra in northern Luzon, situated approximately 450 kilometers north of Manila. The area is primarily in the uplands, generally mountainous with small patches of flatlands. The dominant source of livelihood is tobacco, maize, and vegetable farming, which accounted for 44 percent of total employment at the time of the study. Nearly half of all farmers owned land, but the average farm size of 2 hectares was less than half the national average. Because of the generally poor soil and hilly terrain, farm productivity was considerably lower than the national average. Some 15 percent of the population were engaged in livestock production, with freshwater (river) fishing as a secondary source of livelihood. About 21 percent of the household breadwinners were employed outside the province (7 percent overseas as contract workers or as seamen), mainly because of the limited economic opportunities in their home villages. The nonfarm labor force in Abra was absorbed by small home industries, by the informal and service sectors as wage earners

Figure 2—Map of the Philippines indicating study areas



(30 percent), or as professional and salaried workers in government and private sectors (10 percent).

The low household income per capita in Abra reflects the poor economic conditions in the study villages. Nearly three-fourths of household expenditures went to food, compared to 57 percent for the rest of the Philippines. The average family size in Abra was 6.30 people, and the average years of schooling were 7.06 years for fathers and 7.04 for mothers (Table 3). A third of all children were below 7 years of age, indicating a young population and a high dependency ratio. One of every five preschool children was either moderately

Table 2—Study areas of the Philippine pilot food price subsidy scheme

Study Provinces and Villages	Study Treatment: Rice and Oil Subsidy	Study Treatment: Oil Subsidy	Study Treatment: No Subsidy	Study Treatment: Nutrition Education	1983 Population	Locational Characteristics	Economic Base	Ecology
Province of Abra								
Tangadan (San Quintin)	x				1,078	20 kilometers from provincial capital along main road; accessible through main road	Maize, tobacco, and livestock production; firewood	Upland and mountainous
V. Mercedes-Pobl (San Quintin)	x			x	1,211	15 kilometers from provincial capital along main road	Maize, tobacco farming	Upland and mountainous
Quillat-Baac (Langiden)			x	x	621	8 kilometers from provincial capital; accessible by boat across the river	Maize, rice, tobacco, vegetable farming	Upland and mountainous
Nalnas Poblacion (Langiden)			x		718	16 kilometers from provincial capital; accessible by boat	Fishing on river banks, maize, rice farming	Upland and mountainous
Province of Antique								
Funda (Hamtic)	x				1,360	12 kilometers from provincial capital; accessible by main road	Sustenance fishing, rice, coconut, farming, wages/professionals/service workers	Coastal area
Guintas (Hamtic)	x			x	1,251	8 kilometers from provincial capital; accessible by main road	Fishing, rice, coconut, vegetable farming	Coastal area
Butuan (Anini-y)		x		x	880	65 kilometers from provincial capital	Fishing, services, marginal farming of rice	Coastal area
Bayo (Anini-y)		x			917	70 kilometers from provincial capital	Fishing, services abroad, native industries	Coastal area
Magcalon (San Jose)			x	x	507	3 kilometers from town center	Fishing, rice, maize, and vegetable farming, wages/professionals/service workers	Coastal area

(continued)

Table 2—Continued

Study Provinces and Villages	Study Treatment: Rice and Oil Subsidy	Study Treatment: Oil Subsidy	Study Treatment: No Subsidy	Study Treatment: Nutrition Education	1983 Population	Locational Characteristics	Economic Base	Ecology
San Fernando (San Jose)			x		687	5 kilometers from town center	Rice farming, professionals/ service workers	Coastal area
Province of South Cotabato								
Bolomala I (Tupi)	x			x	1,062	80 kilometers from main city	Maize, rice farming, cottage industries	River basin, flat
Bololmala II (Tupi)	x				852	85 kilometers from main city	Maize farming, cottage industries	River basin, flat
Colongulo (Surallah)			x		1,818	30 kilometers from provincial capital	Maize farming	River basin
Tubi-Allah (Surallah)			x	x	1,746	35 kilometers from provincial capital	Maize farming	River basin

Source: Based on data collected by the International Food Policy Research Institute, Philippines National Nutrition Council, and the Philippines Ministry of Agriculture, "Pilot Food Subsidy Survey, 1983/84," Philippines.

Note: The places in parentheses are municipalities.

Table 3—Characteristics of sample households compared with the rest of the Philippines

Characteristic	Abra	Antique	South Cotabato	Average for the Philippines
Population of study areas, 1983	3,628	5,682	5,478	. . .
Number of households in sample survey[a]	240	360	240	. . .
Household characteristics				
Household size	6.30	6.52	6.41	6.14[b]
Adult equivalent units (AEU)	4.96	5.07	5.09	4.80[b]
Years of schooling, father	7.06	7.06	6.25	n.a.
Years of schooling, mother	7.04	7.53	6.74	n.a.
Per capita income (P/year)	1,680	1,768	1,505	n.a.
Percent of income spent on food	71.13	60.37	71.60	50.20[b]
Percent of expenditures spent on food	73.90	69.50	71.00	57.00[b]
Calorie acquisition in AEUs	1,818	1,915	1,736	. . .
Calorie intake in AEUs	1,755	1,720	1,613	1,808[c]
Calorie deficit in AEUs	327	383	410	224[c]
Occupation of main income earner			(percent)	
Farmers with land	23.64	6.80	27.30	14.20[b]
Tenant farmers	12.68	1.90	17.69	n.a.
Landless farm laborers	7.38	3.47	21.41	19.70[b]
Wage earners	30.66	29.45	20.89	29.30[b]
Fishermen	4.43	14.62	4.87	8.60[b]
Professionals/salaried	10.22	24.52	1.00	17.00[b]
Employed overseas	7.14	11.07	5.76	1.10[b]
Others	3.81	7.74	1.79	10.10[b]
Characteristics of preschool children[e]				
Percent of all children below 6 years	33.30	27.36	32.58	26.09[b]
Mean weight as percent of standard for age	82.84	82.71	83.09	84.0[d]
Percent of children second and third degree malnourished	20.72	26.46	23.19	17.2[d]
Mean Z-scores for weight for age	−1.60	−1.72	−1.68	n.a.

Sources: Data for the three provinces were collected by the International Food Policy Research Institute, Philippines National Nutrition Council, and the Philippines Ministry of Agriculture, "Pilot Food Subsidy Survey, 1983/84," Philippines. Averages are taken from the sources indicated below.

Notes: The z-score is a method used in standardizing the distribution of actual weight of the child relative to the standard weight for a child of that sex and age. The standards devised by the U.S. National Center for Health Statistics (NCHS) were used in the study. n.a. means not available.

[a] This is the number of households randomly selected to be surveyed at the start of the experiment, 1983.

[b] Philippines, National Economic and Development Authority, *Philippine Statistical Yearbook* (Manila, NEDA, 1984).

[c] Philippines, Food and Nutrition Research Institute, *Nationwide Food Consumption Survey,* 1985.

[d] Strictly speaking, these results taken from Philippines, Food and Nutrition Research Institute (FNRI), are not comparable to the data for the three provinces included in the survey because FNRI uses Philippine child growth standards, whereas the study uses international (NCHS) standards.

[e] These data are from the first survey round.

or severely underweight—a higher figure than in most parts of the country.

The second group of pilot villages is located in Antique, a province on the island of Panay in the central part of the Philippines. The villages are situated along a narrow coast bounded by mountains to the east and the sea to the west. The area is one of the least arable in the country.

Because of the limited land resources, most of the area's population is engaged in nonfarm employment. At the time of the survey, about 30 percent were wage workers in local industries and crafts, 24 percent were salaried and professional workers, and 15 percent were fishermen. Only 12 percent of the heads of households in the study areas in Antique were engaged in farming, mainly in marginal maize, rice, and coconut production.

Per capita incomes in Antique were higher than in the two other pilot areas, but still below the national average. The 60 percent proportion of income spent on food was nearer the national mean than that of the two other areas. However, the incidence of second- and third-degree malnutrition, at 26 percent, was highest among the three pilot areas and particularly prevalent among small fishermen.

The third group of pilot villages is located in the province of South Cotabato, on the island of Mindanao. Located in a rich river basin, the area is one of the main maize-producing provinces in the country. In 1983, two-thirds of its population were engaged in farming, mostly growing maize used as animal feed. South Cotabato had a high tenancy rate; less than half of the farmers owned land, and 21 percent were landless farm laborers. About 20 percent of the heads of households were wage earners in secondary and service industries.

In the pilot areas of South Cotabato, the population is composed largely of second generation migrants from Luzon and Visayas. About 15 percent are natives (tribal minorities) who have been assimilated into the Christian population of immigrants. Per capita incomes in South Cotabato were the lowest among the pilot areas. The share of total income spent on food—72 percent—was high compared to the national average. Per capita calorie deficits exceeded 400 per day, and the native minority groups were the most affected by calorie inadequacy. Malnutrition among preschool children, estimated at 23 percent, was moderately high. Levels of educational attainment were also lower in South Cotabato than in Abra or Antique (Table 3).

Population Coverage of the Pilot Scheme

The total population of the study villages was 14,788 at the start of the experiment in May 1983. Out of these, some 1,407 households (8,611 people) received the subsidy, while the rest were treated as a control group. A total of 840 households with 5,376 members, or about one-third of the total population of the villages, were randomly selected for the pilot study. A total of 88 households out of the 840 households dropped out in the second round of interviews and hence were excluded from the study.

4

ASSESSMENT OF IMPLEMENTATION

The purpose of this chapter is to assess the effectiveness of the design of the scheme based on experience and monitoring. For a continuous period of 12 months, the pilot subsidy scheme was observed under actual operating conditions. This involved the monitoring of key participants of the program: the beneficiaries, retailers, wholesalers, participating banks, extension officers, and local political functionaries. The feasibility of the program instruments—ration cards, reimbursement vouchers, and sales logbooks—were tested under local conditions. A full-time study team from the central office of the National Nutrition Council, Ministry of Agriculture, and the International Food Policy Research Institute supervised the scheme for the entire period of operation. In addition, local extension officers were designated to provide periodic onsite monitoring.

The findings exposed a number of implementation problems that were not foreseen in the design of the scheme. The implications of these constraints are discussed here because they are critical to a possible larger-scale future program.

The Geographical Targeting Method

Eligibility for participation in a scheme that targets beneficiaries by geographic area is determined by residency. From an administrative point of view, the requirements for beneficiary certification in such a scheme are simple. For the pilot scheme, problems in verification of residence using the village census were few because families were usually known to the extension workers covering those areas.

Because the subsidized ration was based on household size, some families lied about the size of their households in order to draw larger quotas. To settle conflicting claims of household membership, cases were normally decided by the *barangay* captain, the local political leader. The *barangay* captain also decided whether families were bona fide residents of the *barangay* or precinct, entitled to participate in the program. At least 20 percent of the participating households padded reports of household size. There were a few migrant households and temporary settlers who were not in the census but were nevertheless included in the initial program listing.

Although area targeting is easier to administer than other forms of screening, such as income eligibility or sex and age criteria, several unanticipated effects were observed. A few households invited relatives from neighboring villages excluded from the subsidy into the targeted villages to share the subsidy benefits with them. This was observed only among the very poor households and only in the first half of the experiment. It is unlikely that large-scale population movements would occur as a result of an area-targeted subsidy such as this. However, movement would likely be proportional to the size of the subsidy envisioned. In the pilot study, the level of subsidization compared to incomes was quite low; hence the in-migration was limited.

The geographical area targeting scheme assured coverage for all the needy households in the depressed village because the subsidy was available to everyone within the area. The major disadvantage of such a method, however, is that poor households who live outside the target area are excluded, while well-off households and well-off individuals in deficit households in the area are included.

Possible Problems

Leakages

The goal of the subsidy scheme was to increase and sustain the ability of the food-deficit poor households to purchase enough food to meet nutritional requirements. By definition, therefore, program benefits that were lost in the process of implementation or that accrued to households that did not need them are considered "leakages." Alternatively, leakage can be defined as the difference between the value of food or cash transfer, and the value of the net increment of the food intake of the food-deficit or needy households.[8]

Several overt forms of leakage were observed in the pilot scheme. First, because the program did not discriminate against any household within a project village, households without a deficit (mostly higher-income households) in the villages were included in the program. Consequently, leakages were low if the majority of the households in the villages selected were calorie-deficit households. The efficiency of the area method of targeting is therefore a function of the national agency's accuracy in identifying poverty areas and the degree of geographical concentration of malnutrition. The food consumption survey conducted just prior to the enforcement of the scheme found that 73 percent of the households were deficient, which shows that targeting was relatively efficient.

In two villages in the south, a few economically well-off households shared their rations with poorer neighbors, thus reducing leakages. Some better-off households allowed their poor neighbors the use of their food discount cards, although discount cards, strictly speaking, were not transferable. These transactions, which were done with the knowledge of the store owners, involved no compensation.

During the 12-month monitoring period some cases of reselling of subsidized food were observed, although this was not rampant. All reselling cases involved cooking oil, which was attractive for the very poor families because the product commanded a good price in the open market. For instance, a family of six with a monthly allocation of 2.4 kilograms of cooking oil stood to gain about P 15 if it sold all its ration, an amount that was almost equal to half a day's wages. There was almost no resale of rice observed, mainly because rice is a staple food, and the ration for each family was only about half of what a typical household consumes.

In two villages in the north several enterprising households used all of their cooking oil ration in their small native delicacy business, not for home consumption. In a number of instances some retailers preempted the rations of households that did not consume all of their quota for the month. These practices were particularly difficult to check because the retailers could forge signatures in the salesbook records, and monitoring by the extension officers could only be done once a week.

Use of Food Discount Cards

Some problems were encountered in the use of the food discount ration cards in the retail stores. Two signatures were needed for every sales transaction in the stores: the retail store owner had to sign the ration card and the card holder had to sign the store salesbook. This procedure delayed the transaction, especially in the stores that served larger populations. Illiterate beneficiaries who could not sign the salesbook created another administrative problem. For this group—about 8 percent of the target households—a thumb mark was used to carry out the transaction. Another problem was generated by participants who in the first two months of the experiment deliberately changed the ration amount stated on the discount cards by tampering with the figures on the cards. These were easily detected when compared with the records of the stores.

Accountability and Controls

The use of local banks in the handling of subsidy reimbursements to the retail store owners was quite efficient and would probably be just as feasible in a larger program. The special savings deposit provided a convenient procedure for the redemption of the subsidies by the store owners. Because the size of the subsidy was predetermined from the potential number of beneficiaries, the amount transferred every month by the central program office into the deposit accounts was accurate to within 94 percent of the actual subsidies.

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[8] The measurement of leakage is explicitly treated in Chapters 6 and 10.

The weekly auditing of the books in the store presented some difficulties at the start of the project, but once the extension officer and the retailer became familiar with the procedures, the accounting tasks progressed without exceptional problems. Part of the difficulty in the auditing procedure could be traced to the small but frequent purchases, which resulted in a large number of bookkeeping entries.

Administration of Food Outlets

The procurement and selling performances of the accredited neighborhood *sari-sari* stores varied by area. The differences in efficiency were dependent on a number of factors, including the size of the population served, frequency of purchase, amount of revolving capital and supply credit, the amount of credit extended to customers, the location of the store, and the character of the retailers and their community acceptance.

The outlets in Antique, which served a larger clientele, experienced more difficulty than those in the other two provinces. The queuing and crowding in the stores, especially during the heavy buying days, sometimes resulted in bookkeeping errors in these larger villages. The owners of the retail outlets indicated that, given the frequent purchasing habits of households, the optimum number that each storekeeper could efficiently handle was not more than 120 households, assuming that the store was attended to by the store owner and an assistant, who was usually an immediate member of the family.

In most areas poor households made frequent purchases but in small quantities. Many households, for example, bought cooking oil three times a day, and the purchases were as small as one-half cup (80 grams). Store records compiled for the project indicated that 28 percent of all households made daily purchases. This practice increased the transaction time in the stores per unit purchased. Most stores reported heavier selling late in the afternoons when the breadwinners arrived from work or when the day's fish catch was sold.

Stores that had more than P 10,000 (U.S. $900) of revolving capital were effective in maintaining uninterrupted selling operations. On the other hand, smaller stores experienced intermittent shortages in the supply of the commodities. Although weekly credit was available from commercial rice wholesalers, the amount allowed depended on the capitalization of the store. Hence, smaller stores were not assured of sufficient credit to meet the demand. On the basis of the 12-month store records, it is estimated that in order to support a client base of 120 families a retail outlet should put up an initial revolving capital of at least P 10,000 in 1983 pesos.

It was a common practice in neighborhood stores to give weekly credit to regular clients. Larger stores offered credit on the subsidized food, but the smaller stores did not because of limited revolving capital. Families located on the fringes of the subsidized villages experienced difficulty in obtaining subsidized food because of their distance from the stores. These families usually made one-time bulk purchases, but even so transport costs increased the total food acquisition cost of these beneficiaries. The geographical distribution of target households should therefore play a crucial role in the choice of outlets for a program.

In some instances neighborhood politics hampered the scheme's delivery mechanism. In Abra, for example, one retailer refused to sell subsidized rice to constituents not belonging to her political party. Another store owner refused to sell to people who had a long-standing feud with her family. Some cultural minority groups were not properly attended to in the stores in South Cotabato and were effectively denied their subsidized rations. However, more than half of the retailers were observed to be quite sensitive to community needs, even opening their stores late at night in order to serve their clients. Based on this experience, it is quite apparent that the choice of the retailer is crucial in program delivery. One of the important considerations in selecting an outlet is community acceptance of the retailers.

Subsidy Take-out Trends

Records compiled at the stores for the initial month of the experiment indicate that only 85 percent of the rations made available were claimed by the villagers, but this take-out rate increased to 95 percent after the third month. Households that did not get all of their subsidized food rations were those that had insufficient cash available during the month, were growing rice, or were too far from the stores to be able to take advantage of the lower price.

The rate of ration utilization varied by commodity. Almost all rice rations were taken but only 80-85 percent of cooking oil rations, probably because the cooking oil ration was larger than the amount consumed before the scheme, while the rice ration was not. Under these conditions, households can be expected to consume all of their rice allocations, but they may decide to buy only as much as or slightly more cooking oil than they used before, if reselling is difficult.

Monitoring

The monitoring clearly demonstrated that the efficiency of scheme implementation depended largely on adequate understanding by program participants of the program's objectives, mechanics, and benefits, and on the retail store owners' understanding of program procedures. Social preparation activities were conducted by local extension officers of the Ministry of Agriculture, assisted by the BNS. Monitoring of both the retail stores and the beneficiaries was done by extension officers as part of their work on the project areas. Prior to implementation, village assemblies were held to explain the scheme's mechanics and objectives. These assemblies were undertaken with the cooperation of the local political councils in the project areas.

There were no major difficulties in delivering nutrition education because all of the extension workers had prior experience in this type of intervention. Eighty-five percent of all mothers in the project areas attended nutrition education classes regularly. For the most part, the mothers who did not attend were unable to combine attendance with wage labor. It is difficult, however, to assess the degree of effectiveness across the villages because there were obvious differences in the abilities of the extension officers in delivering the nutrition education messages. The effects of nutrition education on the outcome variables (calorie intake and child nutrition) are discussed in Chapters 8 and 9.

In summary, except for a few details, the scheme's design as initially conceived was generally feasible from an administrative standpoint. Several important lessons were learned from the monitoring on ways to enhance its viability if the scheme were applied on a larger program level.

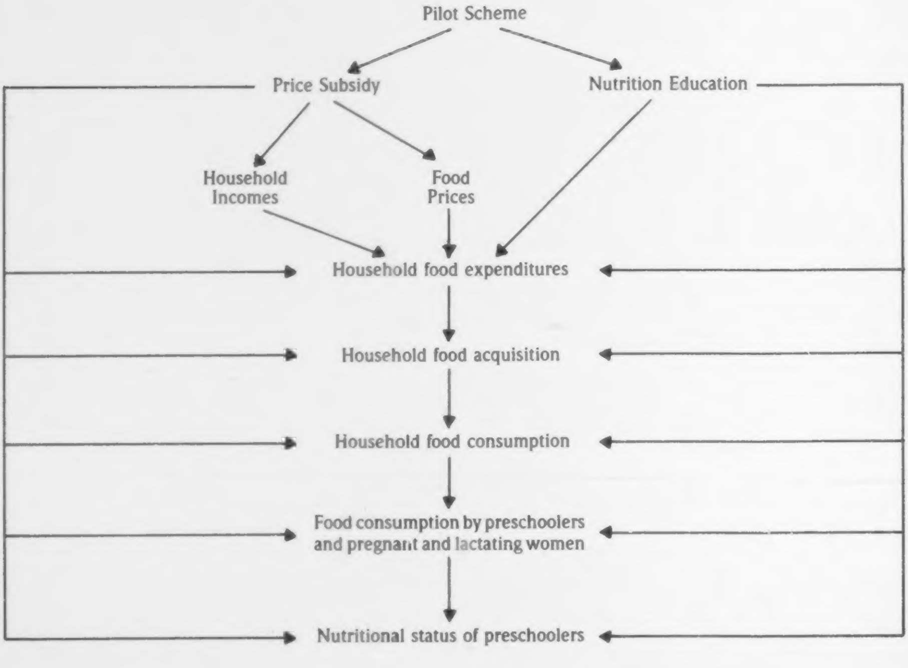
5

ANALYTICAL METHODOLOGY

The analysis of the impact of the pilot scheme on household food expenditures, acquisition, and consumption, and on food consumption and the nutritional status of preschoolers is based on a conceptual framework shown in a simplified version in Figure 3.

The price discount element of the scheme implies an increase in the real purchasing power or income of the recipient households. This increase can in turn be expected to increase household food expenditures, acquisition, and consumption. It may also result in increases in food consumption by the household members most likely to be calorie-deficient—preschoolers—and thus improve their nutritional status (Figure 3). If the amount of subsidized rice or oil exceeds the amount that would be purchased by the households without the subsidies, the subsidies will reduce the price households pay for the last unit (at the margin). This could be expected to increase the consumption of the subsidized foods. These price-induced increases would not be expected, however, if the amount subsidized were less than the amount the household would purchase without the subsidies because the price at the margin would not be affected. The price subsidies may also affect food expenditures, consumption, and nutritional status directly through changes in household behavior.

Figure 3—Simplified version of the conceptual model underlying the analyses


Pilot Scheme
Price Subsidy
Nutrition Education
Household Incomes
Food Prices
Household food expenditures
Household food acquisition
Household food consumption
Food consumption by preschoolers and pregnant and lactating women
Nutritional status of preschoolers

The nutrition education component of the scheme may also affect food expenditures, consumption, and nutritional status by changing household behavior regarding food purchases, dietary patterns, intrahousehold food distribution, and other aspects. The effects of each of the two components—price subsidies and nutrition education—on each of the five indicators shown in Figure 3—household food expenditures, acquisition, and consumption, food consumption by individual preschoolers, and their nutritional status—are estimated by means of comparative static and multivariate analyses.

Comparative Analysis

The experimental design used in this study is illustrated in Table 4. Data were collected from four rounds of surveys in the 14 villages over a 17-month period. About two months after the first survey round was initiated, subsidized rice and oil were made available to survey villages in each of the three provinces. In addition, subsidized oil alone was made available to two villages in one of the provinces. The two other villages from each province that were included in the study were not given access to subsidized food; they served as controls. In each province, a nutrition education program was introduced in one of the two villages that received subsidies and one of the two that did not.

The second survey round was executed about 2 months after the introduction of the subsidy scheme, the third 12 months after the first, and the fourth and last round was undertaken about 2 months after the scheme was terminated, that is, 12 months after the second survey. The spacing of 12 months between surveys was done to avoid confounding effects of seasonal variations.

The control villages were selected to be as similar as possible to the "treatment" villages—those receiving subsidies. Thus, effects of exogenous variables that could not be controlled or accounted for in direct comparison are assumed to have the same effect on control and treatment villages and can therefore be separated from the effects of the scheme.

The effects of the subsidies and nutrition education are estimated simply by comparing the appropriate treatment and control villages after adjusting for differences prior to the introduction of the scheme (the treatment). Analysis of variance is used to test for significant differences. The percent change in each of the five indicators of interest due to subsidies and/or nutrition education is estimated:

$$A_i = [(T_i/C_i)/(T_1/C_1) - 1]\,100, \qquad (1)$$

where

A_i = percent change in the indicator for month i relative to the baseline value of the indicator due to the treatment, for example, the percent change in household food consumption due to nutrition education;

T_1 and T_i = average value of the indicator for round 1 (baseline) and month i for treatment households; and

C_1 and C_i = average value of the indicator in round 1 (baseline) and month i for control households.

The results of the comparative static analyses are presented in Chapter 7.

Multivariate Analysis

Results from comparative static analyses are suspect because the effects of other factors on the groups are not fully accounted for. Multivariate analyses suffer considerably less from this problem because the effects of many factors may be isolated from the effects of the pilot scheme. Therefore, in addition to comparative static analyses, multivariate analyses are used to estimate the impact of the scheme. These analyses are based on the conceptual model presented in Figure 4, which shows the variables hypothesized to influence the indicators and thus included in the multivariate analyses.

Table 4—Experimental design of the pilot food price subsidy study

Commodities Subsidized	Nutrition Education	Province	Survey Rounds 1[a]	2[b]	3[c]	4[d]
Rice and cooking oil	Yes	Abra	x	x	x	x
		Antique	x	x	x	x
		South Cotabato	x	x	x	x
	No	Abra	x	x	x	x
		Antique	x	x	x	x
		South Cotabato	x	x	x	x
No subsidy	Yes	Abra	x	x	x	x
		Antique	x	x	x	x
		South Cotabato	x	x	x	x
	No	Abra	x	x	x	x
		Antique	x	x	x	x
		South Cotabato	x	x	x	x
Oil only[e]	Yes	Antique	x	x	x	x
	No	Antique	x	x	x	x

[a] This was the baseline survey, 2 months prior to introduction of the scheme.
[b] This survey took place 2 months after introduction of the scheme.
[c] This survey took place 10 months after introduction of the scheme.
[d] This survey took place 2 months after the scheme was terminated.
[e] In two villages of one province, only oil was subsidized at the request of the Minister of Agriculture.

Household Calorie Consumption Functions

Four of the five indicators—household food expenditures and acquisition, and food consumption and nutritional status of preschoolers—are regressed on the variables shown in Figure 4 to estimate the effect of the price subsidies and nutrition education on each of the indicators and to isolate the effects of other variables hypothesized to influence these indicators. The impact of the price subsidies is measured partly through the increase in household incomes and the decrease in rice and oil prices and partly through a direct effect hypothesized to come about primarily because households treat the real income increase from food subsidies differently from other income increases—that is, the marginal propensity to spend on food differs between subsidy income and other real income.[9]

The general estimating model used to estimate the impact of the scheme on household food expenditures and acquisition is

$$C = f(Y, S, P_R, P_o, NE, Z), \qquad (2)$$

where C is total food expenditure (or calorie acquisition), Y is real household income, S is the subsidy term, P_R and P_o are the real price of rice and cooking oil, respectively, NE is nutrition education, and Z is a set of other variables hypothesized to influence the dependent variable. Here the dependent variable is a composite of expenditures on all foods or an aggregation of total calories from all of the foods acquired by the household.

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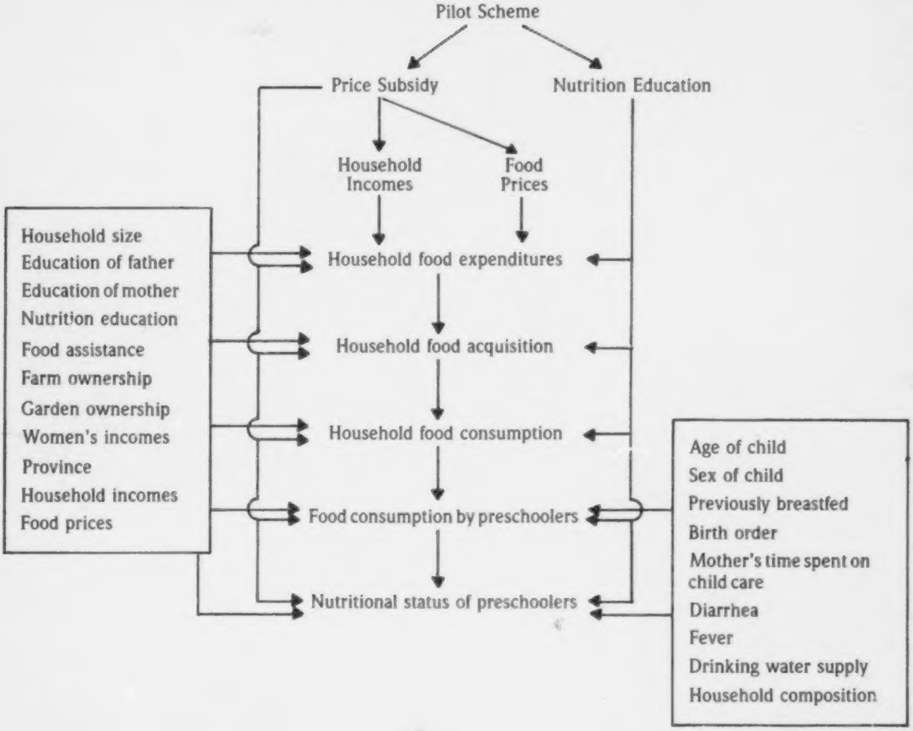
[9] Evidence of such differential treatment of subsidy income has been found for the U.S. food stamp program (Ben Senauer and Nathan Young, "The Impact of Food Stamps on Food Expenditures: Rejection of the Traditional Model," *American Journal of Agricultural Economics* 68 [February 1986]: 37-43). None has been found, however, for the Sri Lankan food stamp program (Neville Edirisinghe, *The Food Stamp Scheme in Sri Lanka: Costs, Benefits, and Options for Modification*, Research Report 58 [Washington, D.C.: International Food Policy Research Institute, 1987]).

Figure 4—Conceptual model underlying the multivariate analyses


Pilot Scheme
Price Subsidy
Nutrition Education
Household Incomes
Food Prices
Household size
Education of father
Education of mother
Nutrition education
Food assistance
Farm ownership
Garden ownership
Women's incomes
Province
Household incomes
Food prices
Household food expenditures
Household food acquisition
Household food consumption
Food consumption by preschoolers
Nutritional status of preschoolers
Age of child
Sex of child
Previously breastfed
Birth order
Mother's time spent on child care
Diarrhea
Fever
Drinking water supply
Household composition

The household-level estimating model is defined:

$$
\begin{aligned}
C_i/AEU = {} & b_o + b_1 Ln(Y_i/AEU) + b_2 S_i \\
& + b_3 HHsize_i + b_4 EducS_i \\
& + b_5 EducH_i + b_6 Nutredc_i \\
& + b_7 Nutrelv_i + b_8 Foodasst_i \\
& + b_9 Ownfarm_i + b_{10} Owngard_i \\
& + b_{11} PwomenY_i + b_{12} L_{2i} + b_{13} L_{3i} \\
& + b_{14} Price_i + b_{15} Poil + u_i , \qquad (3)
\end{aligned}
$$

where

C_i/AEU = food consumption of household i defined either as total food expenditure per adult equivalent unit (AEU), or as total calorie acquisition per AEU;

Y_i/AEU = total income per AEU of household i;

S_i = subsidy term defined either as a percent of total incomes, or as a dummy, 1 if households received the subsidy and 0 otherwise;

$HHsize_i$ = household size;

$EducS_i$ = educational level of the wife;

$EducH_i$ = educational level of the husband;

$Nutredc_i$ = a dummy defined as 1 if the household received nutrition education from government programs, 0 otherwise;

Nutrelv_i = a dummy defined as 1 if the household participated in the nutrition education classes under the pilot subsidy scheme, 0 otherwise;

Foodasst_i = a dummy defined as 1 if the household participated in food assistance programs, 0 otherwise;

Ownfarm_i = a dummy defined as 1 if the household owned a farm, 0 otherwise;

Owngard_i = a dummy defined as 1 if the household owned a garden, 0 otherwise;

PwomenY_i = proportion of total incomes contributed by women;

L_{2i} = location dummy for Antique;

L_{3i} = location dummy for South Cotabato;

Price_i = unit price paid for rice by the household; and

Poil_i = unit price paid for oil by the household.

The two alternative specifications of the subsidy are used to test the robustness of the estimates of the scheme's impact. Each of these implies different assumptions and levels of constraint imposed on the consumption function. The first alternative uses a proportion term (the subsidy as a percent of total incomes from all sources including the subsidy itself). If the coefficient of this subsidy term is not significantly different from zero, the marginal propensity to consume (MPC)—to acquire food—does not change with the changing proportion of total incomes coming from subsidies. A positive and significant coefficient would indicate that income transfers embodied in the scheme have a higher MPC than other household income, and vice versa.

The specification of a dummy for subsidy recipients is interpreted as a parallel shift in the relationship between consumption and income. Therefore, a positive and significant coefficient of the dummy subsidy variable would indicate an effect above the income effect. However, this subsidy variable predicts an impact that does not vary across income groups. This model is hence less intuitive, although empirically predictive of the subsidy effects at the mean level of income.

The use of an AEU scale in the food consumption and income variables explicitly accounts for the differences in household size and composition. The AEU approach is a refinement to the consumption per capita and income per capita approach, as it explicitly accounts for the differences of age composition of households.[10] For this study, the AEU scale used to translate family members of different ages into equivalent person units is derived from the Philippine recommended dietary allowances (RDAs) for calories for each sex-age group.[11] Thus, formulating incomes and consumption in AEUs allows flexibility in economies of scale and size and composition of households.

The income variable is specified in natural logarithm to allow for decreasing MPC for food with increasing incomes. Because of inherent problems in correctly measuring income, particularly in semisubsistence households, total expenditures were used as income proxy throughout the regressions. Because, as discussed in Chapter 8, household incomes are not strictly exogenous, the validity of the results is tested using wage rates instead of incomes.

The impact of the other component of the pilot scheme, the nutrition education intervention, is tested with a dummy variable equal to 1 if the household received the nutrition education and 0 if not. Various socioeconomic and locational variables are included as explanatory variables, specifically to isolate the effects of incomes and subsidies from other socioeconomic, demographic, and locational factors.

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[10] S. J. Prais and H. S. Houthakker, *The Analysis of Family Budgets* (New York: Cambridge University Press, 1971); and Angus Deaton and John Muellbauer, *Economics and Consumer Behavior* (New York: Cambridge University Press, 1980).

[11] Food and Nutrition Research Institute, and National Nutrition Council, *Recommended Dietary Allowances for Filipinos* (Manila: FNRI, 1976).

The prices of rice and cooking oil used as independent variables in the regressions are data reported from the survey. In using the unit price for rice as an explanatory variable, the market price paid is used for households where the rice subsidy is inframarginal; in the extramarginal households the price used is the price that the households paid in the subsidy stores. Price, expenditure, and income variables are deflated by price indexes for the particular month when the survey was carried out, and for the particular region where the samples were located. The use of real values in the regressions is designed to separate the effect of the increase in real income through the subsidy scheme from an increase in expenditures through inflation. The first survey is used as the baseline (index = 100) in deflating the nominal values.[12] The results from the regressions are shown in the Appendix, Table 34, and the main findings are presented and discussed in Chapter 8.

Household Consumption Functions for Rice, Oil, Fish, and Maize

In order to better understand how the scheme influenced the consumption of the principal food commodities, the calorie consumption function is complemented with consumption functions for each of the four principal food commodities—rice, oil, fish, and maize. The commodity functions are specified using the calorie consumption functions above, except that the prices of maize and fish are added. The coefficients estimated by these functions are shown in the Appendix, Table 35, and discussed in Chapter 8.

Calorie Consumption Functions for Preschoolers

To estimate the impact of the scheme on the consumption of calories by individual preschoolers, this model is used:

$$
\begin{aligned}
IC_j = {} & b_0 + b_1 LnAge_j + b_2 Sex_j + b_3 CBreastf_j \\
& + b_4 PBreastf_j + b_5 BirthO_j + b_6 EducH_i \\
& + b_7 EducS_i + b_8 ChTime_j + b_9 HHsize_i \\
& + b_{10} Perchd6_i + b_{11} Diarrhea_j \\
& + b_{12} Water_i + b_{13} Nutrelv_i \\
& + b_{14} Nutredc_i + b_{15} Foodasst_i + b_{16} L_{2i} \\
& + b_{17} L_{3i} + b_{18} PwomenY_i \\
& + b_{19} Ln(Y_i/AEU) + b_{20} S_i + b_{21} Price_i \\
& + b_{22} Poil_i + b_{23} Fever_j + U_i , \qquad (4)
\end{aligned}
$$

where

IC_j = daily calorie consumption by preschooler j,

$LnAge_j$ = log of the age of preschooler j,

Sex_j = sex of preschooler j (1 if male),

$CBreastf_j$ = zero-one dummy (1 if the preschooler is currently breast-fed),

$PBreastf_j$ = zero-one dummy (1 if the child was breast-fed in the past),

$BirthO_j$ = birth order of preschooler j,

$ChTime_j$ = time spent in child care by the mother of preschooler j,

$Perchd6_i$ = proportion of children with age less than six years in household i,

$Diarrhea_j$ = zero-one dummy (1 if the preschooler had diarrhea in the past week),

$Water_i$ = zero-one dummy (1 if the household where preschooler belongs has sanitary potable water facility), and

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[12] The price indexes were taken from Philippines, National Economic and Development Authority, *Philippine Statistical Yearbook* (Manila: NEDA, 1985).

Fever_j = zero-one dummy (1 if the preschooler had fever during the past week).

Other terms have already been defined.

The dependent variable in the equation is the calorie content of foods consumed by individual children between the ages of 13 and 83 months. Children less than 13 months of age are excluded from the analysis because breast-feeding of that age group is widespread and the calorie content of breast milk consumed was not estimated.

The pilot scheme's net effect on individual children is hypothesized to come from increases in overall incomes, nutrition education, and from the effects of the subsidy scheme itself. A semilog functional form is chosen to express the relationship between income and individual child consumption. A variant of this model is also tested using household calorie acquisition in place of household incomes. The inclusion of individual child variables such as age, sex, morbidity, birth order, and breast-feeding serve to control for child-specific variations and biological factors, whereas other household variables, such as the parent's education, household size and composition, women's incomes, child care time, rice and oil prices, and geographical location, are included in order to account for household differences that could influence individual calorie consumption of children. The demand equations are estimated by ordinary least squares for the 589 sample preschool children aged 13 to 83 months. Results of the regressions are given in the Appendix, Table 36, and the key findings are presented and discussed in Chapter 8.

Anthropometric Functions for Preschoolers

The effects of the scheme on the growth of preschoolers are estimated on the basis of estimating equations of the following general form:

$$W_j = f(Y_i, S_i, P_{rice}, P_{oil}, C_i, NE_i, Z_{i,j}), \quad (5)$$

where

W_j = an anthropometric indicator of the nutritional status of preschooler j,

Y_i = total income per capita of the household to which the preschooler belongs (i),

S_i = an indicator for the food subsidy,

C_i = calorie consumption by the household to which the preschooler belongs (used only as an alternative to Y_i),

NE_i = an indicator for whether the household received nutrition education from the scheme, and

$Z_{i,j}$ = a set of other variables hypothesized to influence W_j. All Z-variables are identical to those specified in the calorie consumption function for preschoolers.

The dependent variable is specified in five alternative ways: (1) weight of the preschooler, (2) weight as a percent of the standard weight for a particular age, (3) a standardized Z-score for weight-for-age, (4) a standardized Z-score of weight-for-height, and (5) the height as a percent of the standard height for a particular age. Z-scores are a method used to standardize a distribution. International standards are used in estimating the Z-scores because they facilitate comparison with other studies. The Z-scores for weight variables are defined as:

$$Z_{WA} = (W - W^*)/\text{s.d.} \quad (6)$$

where

W = actual weight of the child,

W^* = standard weight for a child of a particular sex and age, that is, the median of the reference population, and

s.d. = standard deviation from the standard for a particular sex and age.

Weight-related measures are expected to be more appropriate than height-related measures for analyses of effects on child growth in the short run. Thus, for the period of time involved in this study, the scheme is less likely to have an effect on height.

Cost-Effectiveness Analysis

For estimating the cost-effectiveness of the scheme, three sources of cost are identified: the cost of administration, the cost of the subsidy or price discount (the price discount per unit of rice and cooking oil times the quantity for which the discount was given), and the cost of the subsidized food paid by the participating households. The first two are borne by the public sector and referred to as "fiscal costs," whereas the last refers to the amount consumers pay for the subsidized commodities. The last two add up to the value of the subsidized commodities at nonsubsidized prices. The cost of the subsidy equals the subsidy benefits to the consumer because all costs of the scheme other than the price subsidy times the quantity subsidized are included under cost of administration.[13] The transaction costs incurred by participants are assumed to be identical to those they would incur with the purchase of nonsubsidized rice and oil. The transaction costs associated with participation in the nutrition education program, including the value of the time spent by the participants, are ignored in the cost estimations.

Effectiveness is measured, first, by the amounts of real income and calories transferred to the participating households including those households with either severe calorie deficits or children weighing less than 75 percent of standard, and, second, by the change in the nutritional status of children.

Table 5 provides an overview of the various measures used to estimate cost-effectiveness. These measures represent different indicators of benefits, such as changes in household incomes and food acquisition, food consumption by preschoolers, and the weight of preschoolers. They also represent five different target groups: all households in the target villages, only households with calorie consumption below 80 percent of requirements, only households with malnourished preschoolers, only preschoolers, and only malnourished preschoolers.

Thus, if the goal of the scheme is to reduce malnutrition among preschoolers, the measures reflect different degrees of leakage. Three sources of leakages are considered. The first source is households participating in the scheme that are not deficient in calories or that do not have preschoolers. The second is substitution between food and nonfood items and among foods resulting in a net increase in household food expenditures and calorie consumption that is smaller than the equivalent real income transfer. The third is when some of the net increase in household calorie consumption is consumed by household members other than preschoolers.

The fiscal cost of transferring one U.S. dollar of real income to all participating households is a crude indicator of cost-effectiveness from a nutrition point of view because all three sources of leakages are present. However, it may be an appropriate indicator if the goal is to transfer purchasing power at a low fiscal cost. One source of leakage is removed if only transfers to calorie-deficient households or households with malnourished preschoolers are considered (Table 5).

The second source of leakage—reduction in food acquisition from sources other than the subsidy—may be deleted from the cost-effectiveness measure by considering the cost of a net increase in household calorie consumption. The third source of leakage is deleted in the indicators that only deal with the effects on malnourished preschoolers.

In specifying the estimation procedures for each of the indicators, an estimate is made of the fiscal cost of transferring U.S. $1.00 of real income, first, to all participating households (H_1),

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[13] Shlomo Reutlinger and Judith Katona-Apte, *The Nutritional Impact of Food Aid: Criteria for the Selection of Cost-Effective Foods,* Discussion Paper WB-ARU Report No. 12 (Washington, D.C.: World Bank, 1984).

Table 5—Overview of the cost-effectiveness measures used in this study

Fiscal Cost	All Participating Households (H_1)	Households Consuming Less than 80 Percent of RDA (H_2)	Households With Malnourished Preschoolers[a] (H_3)	All Preschool Children (C_1)	Preschool Children Consuming Less Than 80 Percent of RDA (C_2)	Malnourished Preschoolers[a] (C_3)
Fiscal cost of transferring U.S. $1.00	x	x	x			
Fiscal cost of a net increase in food acquisition of 100 calories per AEU per day	x	x	x			
Fiscal cost of eliminating the calorie gap	x	x	x			
Fiscal cost of a net increase in food consumption of 100 calories per preschooler per day				x	x	x
Fiscal cost of increasing the average weight of preschoolers by 1 kilogram				x	x	x

[a] Malnourished preschoolers are those with weight-for-age below 75 percent of standard.

$$(C_A + C_S)/C_S, \qquad (7)$$

where C_A is the cost of administration of the scheme, and C_S is the cost of the subsidy (price discount × total quantity of subsidized commodities). This is equal to the value of the subsidy received by all participating households.

Second, the cost of transferring U.S. $1.00 to households with a calorie deficit in excess of 20 percent of requirements (H_2) is estimated:

$$(C_A + C_S)/C_{S80}, \qquad (8)$$

where C_{S80} is the value of the subsidy received by households with a calorie deficit in excess of 20 percent of requirements.

Finally, the cost of transferring U.S. $1.00 to households with at least one preschooler whose weight-for-age is below 75 percent of the standard (H_3) is estimated:

$$(C_A + C_S)/C_{SMC}, \qquad (9)$$

where C_{SMC} is the value of the subsidy received by households with at least one preschooler whose weight-for-age is below 75 percent of standard.

The next step is to estimate the fiscal cost of increasing net household calorie acquisition by 100 calories per AEU per day among households in groups H_1, H_2, and H_3. The cost is given by $C_A + C_S$. The impact on calorie acquisition is estimated from the calorie acquisition function (3):

$$[\partial(C/AEU)/\ln(Y/AEU)]\,VS + [\partial(C/AEU)/S]\,S + b_7 + [\partial(C/AEU)/P_{oil}]\,\Delta P_{oil}, \qquad (10)$$

where

VS = value of the subsidy, and
ΔP_{oil} = change in P_{oil} due to subsidy, and
b_7 = coefficient for nutrition education from the pilot scheme.

Thus, the fiscal cost of increasing the net household calorie acquisition by 100 calories per AEU per day is given by $(C_A + C_S)100$, divided by equation (10) above.

Now, the fiscal cost of increasing the net calorie consumption of preschoolers by 100 calories per AEU per day among groups of C_1 (all preschoolers), C_2 (preschoolers consuming less than 80 percent RDA), and C_3 (malnourished preschoolers) is estimated. The cost is as shown above. The impact is estimated from the calorie consumption function for preschoolers, equation (4), as

$$[\partial(IC)/\ln(Y/AEU)]VS + [\partial(IC)/S]S + b_{13} + [\partial(IC)/P_{oil}]\Delta P_{oil}. \quad (11)$$

The equation is evaluated at the mean for each of the three groups.

Finally, the fiscal cost of increasing the weight of preschoolers is shown above. The impact is estimated from equation (5),

$$[\partial(w)/\ln(Y/AEU)]VS + [\partial(w)/S]S + [\partial(w)/\partial(NE)]NE + [\partial(w)/P_{oil}]\Delta P_{oil}. \quad (12)$$

Data Collected and Survey Characteristics

The analytical framework discussed in this chapter was the basis for choosing the data that were collected in the study.

A stratified random survey of households in the pilot areas was conducted as a component of the project. A random sample of households was drawn from each of the eight subsidized and six nonsubsidized villages for a total sample of 840 households. These households were visited four times during the period between May 1983 and November 1984. Between the first and fourth survey round, 88 households dropped out of the survey. As stated earlier, the first survey was conducted two months prior to the introduction of the food subsidy. This survey provided the baseline information for the scheme. Within two months from the start of the scheme, the second survey was conducted using the same questionnaire as in the first survey. Exactly 12 months after the first survey, a third survey round was conducted. Thus, the first and third surveys were conducted in similar months of the first and second year in order to eliminate possible seasonal effects on income, production, consumption, and nutrition.

The subsidy scheme was in effect for a period of 12 months—July 1983 to June 1984. Two months after the withdrawal of the subsidies, the fourth survey was conducted. One of the purposes of the fourth survey was to understand how household consumption behavior was affected by the withdrawal of the subsidy.

Data were collected for all variables shown in Figure 4. Several modules were included. The first was a socioeconomic survey, including income of each household member; household expenditures on food and nonfood items; size, age, sex, occupation, and education of all household members; time allocated separately by the wife and husband to various activities; a series of questions on household decisionmaking, such as who within the household decides on expenditure patterns and purchases of specific items; environmental sanitation, including toilet and water facilities; and household participation in local government programs.

The second module was a consumption and food acquisition survey including household food consumption; household food acquired from purchases, own production, gifts, and wages; expenditures and prices of food; and only for a subsample of households, food intake by each household member.

Two dietary survey methods were used in the same questionnaire: the 24-hour food weighing method (here called food consumption) and the flexible period recall method (here referred to as food acquisition). The 24-hour food-weighing method was used in both the household and individual food-weighing surveys. Under this method, all items used in food preparation were weighed and so were leftovers. Snacks or foods eaten between meals were also taken into consideration. For the subsample where individual food intake was weighed, interviewers were present at the meal table.

Care was taken not to disrupt eating behavior during meals. Data collection was carried out by trained nutritionists and home economists, all females with at least a bachelor's degree, whose average work experience was six years. The interviewers came from the same provinces where the surveys were conducted in order to overcome language barriers. All interviewers underwent a week of extensive theoretical and field training on the procedures in order to minimize disruptions at mealtimes. For the other households where individual intakes were not taken, foods were weighed prior to cooking, just before the morning meals, and after dinner, when leftovers were weighed.

In the flexible period food recall method, the respondent mothers were asked to recall food expenditures (quantity, unit value, and monetary values) for the immediate past—a day, a week, or a month—which included all foods purchased from the market, foods from their own production either from home gardens or farms, and foods received as gifts or wages. The recall period was made on the basis of the normal frequency of purchase stated by respondent households.

The third module was the anthropometric data collected monthly throughout the study period to determine the health status of preschool children, including weight, height, age, and morbidity of each child less than seven years of age.

6

DESCRIPTIVE ANALYSIS OF INCOME, CONSUMPTION, AND NUTRITIONAL PATTERNS

In this chapter the results of the surveys for the five indicators are disaggregated by province, survey round, occupational group, and income quartile and analyzed to identify differences among population groups that may be useful for targeting of future subsidy programs or other interventions. A secondary but important objective is to gain knowledge about the survey households and individuals over and above what can be learned from the analyses based on the total sample.

Household Income Sources

The overall average monthly income of the sample households during the survey period was P 140 per capita (equivalent to a household income of P 910 per month) as compared to total expenditures of P 117 (Table 6). Some households in the poorest quartile spent slightly more than they earned. This occurred primarily among landless farm workers and tenant farmers other than those producing rice and maize, the two groups that were clearly the poorest of the sample. For the sample as a whole, incomes were considerably higher than expenditures during 1983, but these apparent savings did not continue in 1984, which probably reflects the rapid increase in prices during late 1983 and early 1984. About one-half of all incomes came from salaries and wages and about one-third originated in agriculture and fishing.

Food Acquisition and Consumption Patterns

Household consumption expenditures are used in this study as a proxy for income because consumption expenditure is hypothesized to be a better indicator of permanent income and hence a more important determinant of consumption behavior.[14] Consumption expenditures are also easier to measure, and nonsampling errors for this variable are likely to be much lower than those for incomes, which have been chronically understated in many household surveys.

The average share spent on major consumption items is shown in Table 7. On the average, 71 percent of total household expenditures went to food. This figure was much higher than the national average of 57 percent, which indicates that conditions in the study areas were relatively poorer.

The share spent on food fell as incomes rose in concurrence with Engelian relationships. While the households in the lowest income quartile allocated 79 percent of their total expenditures to food, those in the highest quartile allocated 63 percent. The share of income spent on food increased over time, which may be explained by the higher rate of inflation for rice than for other major budget items between 1983 and 1984. In early 1984, the ceiling price of rice was allowed to increase by about 45 percent over the previous year. Rice accounted for about 39 percent of the total food budget and nearly 26 percent of total household expenditures. Thus, rice prices were important in overall purchasing power.

Table 7 summarizes the budget shares of major expenditure items by province, season (survey round), occupation, and income group. The shares spent on nonfood items increased as incomes rose, particularly clothing and footwear, education, medical services, and housing. Shares spent on food varied widely between farm and nonfarm households. These variations may reflect

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[14] Milton Friedman, *A Theory of the Consumption Function* (Princeton: Princeton University Press, 1957).

Table 6—Average incomes and income sources by province, survey round, occupation, and income quartile

Category	Number of Household Visits[a]	Income Per Capita Per Month[b]	Total Expenditure Per Capita Per Month	Income Source			
				Salaries/ Wages	Farm/ Livestock/ Fishing	Business	Rent/ Interest/ Pensions/ Gifts
		(pesos)		(percent of total income)			
Entire sample	3,167	140	117	51.3	34.4	6.5	7.8
Province							
Abra	908	140	131	43.8	37.9	4.0	14.3
Antique	1,382	149	106	55.7	30.3	8.6	5.4
South Cotabato	877	125	120	50.9	39.4	4.6	5.1
Survey round							
May 1983	840	122	96	50.4	36.4	6.3	6.9
November 1983	799	129	75	47.0	39.0	6.1	7.9
May 1984	776	151	149	54.5	30.3	6.8	8.4
November 1984	752	159	153	53.5	31.9	6.6	8.0
Occupational categories							
Rice farmer landowner	200	148	131	21.8	66.4	4.1	7.7
Maize farmer landowner	222	135	128	12.6	74.8	4.6	8.0
Farmer, other crops	77	136	127	23.0	65.3	1.3	10.4
Tenant rice farmer	87	112	113	19.9	70.7	0.9	8.5
Tenant maize farmer	136	121	118	21.0	70.4	0.5	8.1
Tenant, other crops	50	90	103	17.1	69.0	1.8	12.1
Landless farm laborer	275	98	104	69.4	18.2	3.1	9.3
Wage earner	817	133	107	70.4	19.4	4.6	5.6
Professional/salaried	116	300	218	83.6	11.4	1.7	3.3
Fishermen, boat owners	384	110	105	13.2	77.6	4.2	5.0
Hired fishermen	39	142	94	80.8	14.0	1.7	3.5
Employed overseas	256	191	132	83.5	10.4	3.1	3.0
Occupation unclassified	508	152	123	33.7	28.1	20.6	17.6
Income group							
First quartile (lowest)	791	78	82	41.1	41.6	4.8	12.5
Second quartile	791	100	96	40.3	46.0	6.6	7.1
Third quartile	791	130	118	49.9	37.9	6.2	6.0
Fourth quartile	791	252	173	59.8	25.6	7.1	7.5

Source: Based on data collected by the International Food Policy Research Institute, Philippines National Nutrition Council, and the Philippines Ministry of Agriculture, "Pilot Food Subsidy Survey, 1983/84," Philippines.

[a] "Household visits" is defined as the number of sample households times the number of interviews performed in each household.

[b] Income includes the value of own production consumed.

differences in income as well as the semisubsistence nature of farming. The professionals and salaried workers spent 60 percent on food compared to the poorer wage earners' 81 percent. Surprisingly, food producers, such as rice farmers and fishermen, tended to spend more on food than those who were employed. It is important to note, however, that the present definition of food expenditures covers not only cash food purchases from the market but also the imputed values of food consumed from the households' own food production and food received as gifts and wages.

Food Consumption by Source of Food

For the entire sample, nearly 80 percent of total food expenditures was accounted for by food purchases (including food consumed away from home), 15 percent by own production, 5 percent by gifts received, and a small proportion by foods received as wages. The province of South Cotabato spent more on food purchases and less on food from own production. Nearly one-fifth of Abra's food consumption came from production of their own rice and maize.

Table 7—Percent of total household expenditures on major commodity groups, by province, survey round, occupation, and income class, 1983-84

Category	Total Expenditures Per Capita	Food				Housing/ Fuel	Trans-portation	Medical Services/ Drugs	Edu-cation	Clothing and Footwear	Fiestas and Cere-monials	Durable Goods	Other Goods and Services
		Pur-chased Food	Own Prod-uce	Gifts/ Wages	Total Food								
	(pesos/month)							(percent)					
Entire sample	117	56.1	10.6	4.2	70.9	8.2	2.7	4.1	1.4	4.8	4.0	1.9	2.0
Province													
Abra	131	56.2	12.3	5.4	73.9	8.0	2.0	2.4	1.7	4.1	4.1	1.7	2.1
Antique	106	53.9	12.6	3.3	69.5	8.4	2.6	3.0	1.4	4.7	2.7	3.7	3.7
South Cotabato	120	60.4	6.9	3.7	71.0	8.2	3.6	5.0	1.2	3.9	3.2	2.6	1.3
Survey round													
May 1983	96	56.7	10.1	3.2	70.0	7.1	2.0	6.1	0.0	8.2	6.0	0.5	0.1
November 1983	75	52.1	10.2	3.4	65.7	8.3	2.1	2.3	1.5	7.9	6.5	2.3	3.4
May 1984	149	58.5	10.6	4.7	73.8	8.5	3.2	1.7	1.0	4.8	5.5	1.0	0.5
November 1984	153	55.1	12.6	4.3	72.0	8.8	3.3	2.9	1.8	6.1	1.2	3.3	0.6
Occupational categories													
Rice farmer landowner	131	46.2	19.5	4.1	69.8	7.1	1.9	6.0	1.5	7.6	4.3	0.7	1.1
Maize farmer landowner	128	52.3	10.5	3.9	66.7	8.3	2.0	7.1	1.2	7.1	5.4	1.0	1.2
Farmer, other crops	127	54.7	17.9	2.7	75.3	7.0	2.6	3.0	1.7	4.0	6.2	0.1	0.1
Tenant rice farmer	113	49.4	22.7	4.3	76.4	7.0	1.7	2.8	1.0	2.1	7.1	1.0	0.9
Tenant maize farmer	118	61.7	9.9	4.7	76.3	7.2	3.5	3.2	0.3	2.0	6.0	0.9	0.6
Tenant, other crops	103	59.5	18.1	4.1	81.7	7.4	2.9	1.9	0.5	1.1	4.3	0.1	0.1
Landless farm laborer	104	61.3	10.5	10.9	82.7	8.3	1.6	1.7	0.5	1.0	4.0	0.1	0.1
Wage earner	107	69.1	6.7	5.1	80.9	7.6	4.1	0.7	1.1	3.6	1.7	0.1	0.2
Professional/salaried	218	51.2	5.3	3.5	60.0	10.8	5.0	3.7	3.1	10.1	2.3	3.0	2.0
Fishermen, boat owners	105	58.3	20.9	3.7	82.9	5.5	3.7	2.1	1.0	3.0	1.0	0.2	0.6
Hired fishermen	94	60.9	8.1	7.8	76.8	8.3	2.1	3.2	0.9	2.0	4.7	1.0	1.0
Employed overseas	132	54.4	6.4	2.4	63.2	10.2	3.1	4.2	2.1	8.9	4.3	2.0	2.0
Occupation unclassified	123	51.5	8.7	3.1	63.3	10.0	3.0	4.1	1.7	8.8	4.1	3.0	2.0
Income group													
First quartile (lowest)	82	61.8	10.9	5.9	78.6	7.0	3.0	1.7	0.2	5.0	4.1	0.3	0.1
Second quartile	96	61.4	12.3	5.2	78.9	7.6	2.2	2.7	0.4	5.0	2.1	1.0	0.1
Third quartile	118	59.2	11.4	4.3	74.9	8.1	2.1	3.0	0.5	4.8	4.4	1.7	0.5
Fourth quartile	173	50.2	10.1	2.6	62.9	10.7	2.9	4.3	2.7	8.1	3.3	3.0	2.1

Source: Based on data collected by the International Food Policy Research Institute, Philippines National Nutrition Council, and the Philippines Ministry of Agriculture, "Pilot Food Subsidy Survey, 1983/84," Philippines.

Between 1983 and 1984 the absolute percentage of subsistence consumption—food grown for the household's own consumption—increased, partly indicating the effects of the increase in food prices over the period.

The food acquisition pattern by sources of food varied by occupation. The shares of food consumption from own production, as expected, were highest among the food producers, such as the rice farmers and fishermen. However, even among rice farmers who owned land, about two-thirds of the total food consumed was accounted for by purchases from the market, while 19 percent came from own production and 4 percent was received as gifts. Similar consumption patterns among rural groups were observed by Trairatvorakul in Thailand.[15]

Among the farming groups, the survey indicates a larger proportion of subsistence consumption among rice farmers than maize farmers. This is because most of the people in the sample were rice eaters, and maize is used more as livestock feed than for human consumption in most parts of the Philippines. The landless farm laborers depended on market purchases for 61 percent of their household food expenditures.

It is estimated that 21 percent of the food consumed by the families of boat-owning fishermen came from their own production. Hired fishermen depended on the market for a higher proportion of their household food supply than did boat-owning fishermen. Food received as wages composed 8 percent of the total food consumed by hired fishermen, the second highest percentage of all occupational categories. This reflects the practice of paying hired workers from the day's catch of fish.

Although the samples were all drawn from rural areas, about 48 percent of the households had nonfarming, nonfishing occupations. The main sources of livelihood for the major breadwinners in many households were urban-based or urban-related, despite their rural residences. For these groups, 85 percent of all food consumed came from purchases. About 10 percent of their food supply came from their own production, mostly from backyard fruit and vegetable gardens.

Allocation of the Food Budget by Food Group

Table 8 gives the breakdown of the average household food budget allocated to each food group. There were 124 food groups coded in the survey, and these were aggregated into the 12 main food groups reported in Table 8. The last one is the residual from the first 11 and is designated as "other foods."

For the entire sample, rice accounted for nearly 40 percent of total food expenditures, fish for 18.6 percent, and vegetables and fruits for 11.3 percent.

A comparison of the patterns of food expenditure across provinces indicates that minor variations occurred in rice expenditures, but major differences were found in nonstaple foods. Although South Cotabato is a maize-producing province, its population is basically rice-eating. This explains its lower food expenditures for maize compared to Abra, where part of the population eats maize during certain periods of the year. Abra spent about 2.8 percent of its food expenses on maize, the highest among the three provinces. As expected, the share spent for fish was highest in the coastal province of Antique—23 percent compared to only 13 percent in Abra. Abra's fish supply came mostly from freshwater sources, mainly out of the Abra River. Abra spent more on poultry, fruits, and vegetables than the other two provinces. The other food groups did not vary much by province.

The major differences in the pattern of food expenditures observed were across occupational categories. Certain food items were heavily consumed by the producers themselves. Rice, maize, fruits, and vegetables, for example, were most heavily consumed by farmers, tenants, and farm laborers,

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[15] Prasarn Trairatvorakul, *The Effects on Income Distribution and Nutrition of Alternative Rice Price Policies in Thailand*, Research Report 46 (Washington, D.C.: International Food Policy Research Institute, 1984).

Table 8—Proportion of the food budget allocated to various foods, by province, survey round, occupation, and income group, 1983-84

Category	Per Capita Food Expenditures[a]	Rice	Maize	Bread	Cooking Oil	Poultry	Fish	Pork and Beef	Fruits and Vegetables	Other Foods[b]
	(pesos/month)					(percent)				
Entire sample	78	39.5	1.0	1.5	2.2	4.9	18.6	5.0	11.3	16.0
Province										
Abra	86	37.7	2.8	0.8	1.8	8.4	13.2	5.5	13.1	16.1
Antique	76	37.5	0.1	2.9	2.4	2.1	22.9	3.4	10.9	16.4
South Cotabato	73	43.5	0.1	0.8	2.5	8.1	20.6	4.6	9.9	9.7
Survey round										
May 1983	58	42.3	0.1	1.8	1.9	4.6	21.5	5.8	14.1	7.9
November 1983	62	37.2	0.8	1.6	2.0	3.6	17.5	4.8	12.5	20.0
May 1984	96	36.4	0.3	2.1	2.8	3.8	17.3	2.9	10.9	23.5
November 1984	97	41.3	2.3	1.4	1.9	5.3	17.2	4.9	9.4	15.3
Occupational categories										
Rice farmer landowner	88	38.8	1.3	1.9	1.9	5.9	17.4	6.4	12.2	14.2
Maize farmer landowner	75	42.8	1.5	0.8	2.1	8.9	20.4	5.6	11.2	6.7
Farmer, other crops	85	40.8	0.9	0.5	2.6	4.3	17.3	2.4	15.2	16.0
Tenant rice farmer	81	39.1	1.8	0.6	1.8	1.4	11.9	4.5	14.3	24.6
Tenant maize farmer	78	41.8	0.2	1.3	2.2	8.4	18.1	4.0	11.1	12.9
Tenant, other crops	80	42.1	1.8	0.1	1.9	3.9	7.3	1.5	12.4	29.0
Landless farm laborer	68	45.3	1.4	0.5	1.9	3.8	15.8	1.7	9.9	19.7
Wage earner	74	40.7	0.9	1.8	2.2	4.3	18.5	4.3	10.7	16.6
Professional/salaried	122	25.2	0.3	2.8	3.2	5.1	19.7	9.6	9.8	24.3
Fishermen, boat owners	76	40.8	1.2	1.5	1.9	1.6	21.1	1.1	7.2	23.6
Hired fishermen	78	42.2	0.0	3.8	2.2	0.5	25.3	2.1	9.5	14.9
Employed overseas	84	33.7	0.9	2.8	2.5	3.7	20.5	6.3	9.8	19.8
Occupation unclassified	79	34.5	0.4	2.6	2.3	2.9	21.1	5.2	9.1	21.9
Income group										
First quartile (lowest)	55	46.2	1.1	1.3	1.9	3.2	17.9	4.2	12.1	12.1
Second quartile	82	43.1	1.3	1.3	1.8	3.9	17.1	3.1	11.6	16.8
Third quartile	113	39.8	0.9	1.1	2.2	5.4	18.2	2.8	9.8	17.1
Fourth quartile	213	33.1	0.7	2.6	2.5	4.4	18.7	6.7	10.1	21.2

Source: Based on data collected by the International Food Policy Research Institute, Philippines National Nutrition Council, and the Philippines Ministry of Agriculture, "Pilot Food Subsidy Survey, 1983/84," Philippines.

[a] Per capita food expenditures include the value of food acquired from all sources: purchases, own produce, and foods given as gifts and as wages.

[b] Other foods include cassava, sweet potato, sugar, milk, eggs, and others.

and fish and fish products by the boat-owning fishermen and the hired fishermen. The diets of professionals and overseas workers varied more, as indicated by the smaller proportions spent on staples and the increasing percentage allocated to foods such as meat, milk, eggs, bread, and cooking oil. Within the farming groups, the landless farm laborers had the least varied diet, spending most of their food budget on rice and maize. In general, the composition of the food budget of land-owning farmers was more varied than that of the tenant farmers.

Population groups forming the lowest quartile spent larger proportions of their budgets on staples, such as rice, maize, sweet potatoes, and cassava, and smaller proportions on milk, eggs, meat, and cooking oil. From a high of 46 percent in the lowest income quartile, rice's share of the food budget declined to 33 percent in the highest quartile. Expenditure shares of bread, pork, beef, and cooking oil were largest in the highest income quartile. Shares spent on fish did not appear to vary by income group. This may be because the higher income quartiles in the sample were still at the lower end of the income distribution of the Philippines as a whole.

Food Consumption

In the food-weighing procedure used to estimate food consumption, all food served to household members was weighed before meals and the leftovers after for a given 24-hour period, and each of these foods was converted into calorie equivalents.

Daily calorie consumption, which is based on the 24-hour weighing method, is estimated at 1,701 calories per AEU for the entire sample. This is about 374 calories less than the standard recommended by FNRI.[16] Thus, it appears that the sample area as a whole was deficient in calories. Average measures, however, tend to mask the deficiency levels for particular population groups. For purposes of this analysis, the calorie consumption and adequacy of the sample population was disaggregated by location (province), survey round, occupational grouping, and income group.

Statistics summarized in Table 9, using information from the 24-hour food weighing survey, suggest that the people in South Cotabato were worse off than those in the other two provinces. It was the only province where calorie deficits averaged more than 400 calories per day. As shown in Table 6, South Cotabato had the lowest per capita incomes, indicating a likely relationship between undernutrition and economic deprivation.

Caloric intakes vary significantly even within subsectors of socioeconomic groups based on occupation. For instance, within the farming sector, it is clear that rice farmers who are landowners have higher caloric intakes than farmers growing maize or other crops. It is, however, incorrect to conclude that all rice producers are relatively well-fed. It is evident from the results that the smaller rice producers, like tenant rice farmers, have large calorie deficiencies, and the problem is even more pronounced among farm laborers working in the rice sector: their calorie deficits are the highest of all occupational groups. The significant differences in caloric intakes among the various occupational subcategories within rice farming support the theory that the rice-farming sector is not homogeneous; hence, analysis of policies affecting the sector should explore the distributional patterns within.

The disaggregation of the fishing sector into fishermen who own boats and hired fishermen indicates varying degrees of deficiency between these groups. The significant difference in their means amplifies the

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[16] The Philippine standards for calories were based on the assumption that energy expenditures for Filipinos differ from those of other people because of differences in body size and type, as well as duration of physical activities, rather than because of intrinsic physiological differences. FNRI's energy expenditure and intake studies based on the Philippine population formed the basis for the calorie requirement standards used in this study. A summary of the standards for all sex, age, and physiological status categories can be found in Philippines, Food and Nutrition Research Institute, *Publication No. 75* (Manila: FNRI, May 1977).

Table 9—Diet composition by food groups, survey round, occupation, and income group, 1983-84

Category	Daily Calories Per AEU[a]	Rice	Maize	Bread	Sweet Potatos/ Cassava	Sugar	Cooking Oil	Poultry	Fish	Pork and Beef	Milk and Eggs	Fruits and Vegetables	Other Foods
							(percent of total calories consumed)						
Entire sample	1,701	76.1	2.8	1.7	0.7	1.9	2.9	1.9	3.0	1.5	1.5	3.0	3.0
Province													
Abra	1,755	74.1	7.1	1.0	0.5	2.3	2.1	1.6	1.7	1.3	1.6	3.2	3.5
Antique	1,720	75.3	0.7	2.1	1.3	1.7	3.2	1.7	5.9	1.5	0.6	3.1	2.9
South Cotabato	1,613	78.6	0.8	1.3	0.2	1.9	3.4	2.3	3.0	2.1	1.5	2.9	2.0
Survey round													
May 1983	1,715	77.5	1.0	1.0	0.3	0.2	2.7	1.1	4.5	2.0	1.0	2.9	5.8
November 1983	1,676	76.5	3.5	1.2	0.5	0.9	3.1	1.7	3.5	1.5	1.1	2.8	3.7
May 1984	1,735	79.0	2.0	2.1	1.0	1.5	3.6	1.9	3.5	1.0	1.5	2.0	0.9
November 1984	1,675	75.0	7.0	1.4	1.0	1.9	1.4	1.5	2.0	1.0	2.5	3.6	1.7
Occupational categories													
Rice farmer landowner	1,956	75.6	3.1	1.5	0.3	1.2	2.1	1.2	3.1	1.4	0.8	2.8	6.9
Maize farmer landowner	1,671	77.4	7.0	0.4	0.2	0.7	2.5	2.3	3.2	1.4	0.5	2.4	2.0
Farmer, other crops	1,767	77.0	2.5	0.5	0.1	1.1	3.0	1.2	2.9	1.1	0.4	3.2	7.0
Tenant rice farmer	1,692	77.2	4.6	0.3	0.3	0.7	2.1	3.3	2.2	1.6	0.2	2.4	5.1
Tenant maize farmer	1,659	79.4	0.7	1.1	0.2	0.6	2.7	2.2	2.9	1.4	0.4	2.6	5.5
Tenant other crops	1,718	80.2	5.3	0.1	0.1	0.6	2.2	0.1	1.4	0.4	0.3	2.5	6.8
Landless farm laborer	1,580	81.6	2.9	0.3	0.1	0.7	1.9	1.0	2.7	0.6	0.4	2.3	5.5
Wage earner	1,668	82.2	2.6	1.1	0.1	0.9	2.3	1.0	3.7	1.1	0.5	2.7	1.8
Professional/salaried	1,899	66.9	0.9	2.1	0.3	1.8	4.9	1.6	4.5	3.5	1.5	3.1	8.9
Fishermen, boat owners	1,721	80.7	2.3	1.1	0.5	0.7	2.5	0.5	7.5	0.2	0.3	2.4	1.3
Hired fishermen	1,692	79.7	0.0	2.5	0.1	1.4	2.0	0.0	7.1	0.6	0.5	4.3	1.8
Employed overseas	1,634	74.2	1.8	1.6	0.2	1.6	3.3	0.8	4.3	1.5	0.9	3.1	6.7
Occupation unclassified	1,691	81.8	0.6	1.5	0.3	0.8	2.8	1.1	4.0	1.4	0.4	2.7	1.8
Income group													
First quartile (lowest)	1,627	79.1	2.9	0.2	1.3	0.5	1.9	1.4	3.9	1.0	0.5	3.2	4.1
Second quartile	1,709	78.0	1.9	0.3	0.9	1.2	2.7	1.5	3.7	1.1	0.6	3.1	5.0
Third quartile	1,696	77.1	1.0	1.9	0.2	1.8	3.2	2.3	3.4	1.9	1.8	2.7	2.7
Fourth quartile	1,771	72.6	0.5	2.9	0.1	2.9	4.0	2.5	3.6	2.9	3.0	2.7	2.3

Source: Based on data collected by the International Food Policy Research Institute, Philippines National Nutrition Council, and the Philippines Ministry of Agriculture, "Pilot Food Subsidy Survey, 1983/84," Philippines.

[a] Daily calories per adult equivalent unit were based on 24-hour food weighing.

need to look at the patterns within population groups in order to understand the impact of particular policies. Among the nonfarming occupational groups, wage earners were particularly deficient in calories, while, as expected, the professionals and salaried workers had the lowest average deficits.

Diet Composition

A disaggregation of the sources of calories for the sample households illustrates the overwhelming dominance of rice in the diet, accounting for more than three-fourths of total calories. The dependence on rice holds true in all areas, in practically all seasons, for all occupational categories, and for all income groups. The overall dependence on one staple commodity also implies that, in general, there is little diversity in the diet.

The composition of the average diet varied slightly among the three provinces. Abra showed the least dependence on rice, but its consumption of maize was much higher than that of the other two provinces because maize is eaten in Abra during the lean months. The coastal province of Antique derived the highest proportion of its calories (and protein) from fish.

Meal patterns of a typical household in the sample consisted of staples such as rice (326 grams per capita daily), dried or fresh fish, *bagoong* or fish sauce, leafy vegetables such as *kangkong, malunggay, talong,* and mung beans, and fruit. As mentioned before, in areas where maize is grown, maize supplements rice as a staple, which is eaten as a rice-maize mix. Bread is eaten in the form of a roll made of wheat flour called *pan-de-sal,* which is usually eaten for breakfast. Pork, poultry, and beef are part of the meal only on occasion.

Household Calorie Acquisition

As shown in Table 10, average calorie acquisition for the sample as a whole, based on the flexible recall period (one week or one month), exceeded calorie consumption by 136 calories per AEU per day, or 7 percent. As mentioned earlier, there are several reasons for this slight divergence. First, because no food weighing was done on Saturdays and Sundays, food consumption estimates refer to an average daily consumption for the week based on actual consumption for only five days, Monday to Friday, whereas food acquisition covered all seven days of the week. Moreover, Philippine households usually consume more food during the weekend. Second, part of the difference may also be explained by the failure to take into account wastage in the estimates based on food acquisition.

Although it is not possible to determine the bias of each of the two estimates, and thus the "true" value, it may be hypothesized that the two estimates provide a lower and upper bound. It is also likely that the estimate based on acquisition is closer to the true value because it reflects consumption during all days of the week and because the method itself is unlikely to influence actual consumption.

There was also a slight seasonal variation in the composition of the diets in the sample. The relative importance of rice declined slightly during the lean month of November, compared to May, due to the increase in consumption of maize in Abra. A large proportion of Abra's population eats rice mixed with maize grits on a 60-40 or 70-30 ratio during the maize harvest months from August to November.

Tenant farmers of cash crops, landless farm laborers, and fishermen had the least diverse diets, while the most diverse were, as expected, those of the professionals and salaried workers, the households of workers employed overseas, and the landowning rice farmers. Professionals depended less on cereals for their caloric needs and obtained a relatively higher proportion from such foods as bread, cooking oil, milk, meat, and eggs. The opposite was true for the low-income occupational groups, such as the landless farm laborers, who depended on rice for 82 percent of total caloric intakes.

Table 9 indicates the increasing diversification in the average diet as income increases. This is marked by the decreasing but still significant role of rice and maize in

Table 10—Calorie acquisition by food groups, survey round, occupation, and income group, 1983-84

Category	Daily Calorie Acquisition Per AEU	Rice	Maize	Bread	Sweet Potatos/ Cassava	Sugar	Cooking Oil	Poultry	Fish	Pork and Beef	Milk and Eggs	Fruits and Vegetables	Other Foods
							(percent of total calories acquired)						
Entire sample	1,837	62.7	5.7	1.7	1.6	3.7	3.1	2.0	3.6	1.1	1.8	5.6	7.4
Province													
Abra	1,818	55.4	16.2	1.5	2.2	3.1	2.8	1.7	0.9	1.2	1.3	6.0	7.7
Antique	1,915	65.8	1.1	1.9	0.9	4.0	3.3	1.8	6.5	0.8	1.7	4.7	7.5
South Cotabato	1,736	66.0	1.1	1.8	2.0	3.8	3.2	2.7	2.0	1.6	2.3	6.5	7.0
Survey round													
May 1983	1,777	64.4	1.6	2.2	1.9	4.6	3.4	[illegible]	4.4	1.5	2.0	5.0	7.4
November 1983	1,903	62.5	6.2	2.2	0.8	3.4	4.3	[illegible]	3.4	1.2	2.5	4.7	7.2
May 1984	1,911	63.6	2.6	1.4	2.3	3.5	3.6	2.[illegible]	3.5	1.0	1.5	7.1	7.7
November 1984	1,756	60.1	12.7	1.3	1.3	3.2	1.2	2.6	2.9	0.8	0.9	5.6	7.4
Occupational categories													
Rice farmer landowner	2,012	59.4	10.5	1.5	1.8	3.5	2.6	2.3	2.5	1.1	1.4	6.0	7.4
Maize farmer landowner	1,776	62.6	5.0	1.5	1.7	3.5	2.6	2.9	1.8	1.7	2.5	6.6	7.6
Farmer, other crops	1,899	65.4	2.9	1.7	0.9	3.5	4.2	2.9	2.1	1.3	1.4	5.8	7.7
Tenant rice farmer	1,914	55.7	14.8	1.3	1.7	3.0	2.6	2.7	1.2	1.2	1.7	6.8	7.3
Tenant maize farmer	1,849	62.5	3.4	1.6	2.2	3.7	3.4	2.6	1.9	1.3	1.7	7.7	8.0
Tenant other crops	1,857	57.3	12.0	1.3	2.4	3.2	3.0	1.9	1.3	1.2	0.7	6.3	9.4
Landless farm laborer	1,655	62.7	8.9	1.4	2.2	3.0	2.7	1.9	1.8	1.1	2.1	4.7	7.5
Wage earner	1,767	64.6	5.7	1.7	1.6	3.9	3.0	1.8	2.7	1.0	1.1	5.0	7.9
Professional/salaried	2,184	56.4	3.6	2.8	1.4	5.1	3.9	2.5	2.9	2.7	2.7	8.8	7.2
Fishermen, boat owners	1,926	62.1	4.2	1.6	1.1	2.8	3.1	1.7	10.1	0.5	1.0	4.7	7.1
Hired fishermen	1,877	68.1	0.3	1.8	0.7	3.3	6.5	1.5	8.5	0.7	1.1	3.1	4.4
Employed overseas	1,795	62.3	4.7	2.4	1.6	4.6	3.4	1.7	2.4	1.3	2.3	5.9	7.4
Occupation unclassified	1,849	63.9	4.5	1.9	1.7	4.0	3.4	1.9	2.6	1.2	1.8	6.0	7.1
Income group													
First quartile (lowest)	1,696	64.5	5.0	1.6	1.3	3.4	3.1	1.7	3.9	0.9	1.9	5.0	7.7
Second quartile	1,831	62.8	6.6	1.6	1.7	3.4	3.0	1.9	4.0	0.9	1.5	5.2	7.4
Third quartile	1,852	62.3	5.3	1.8	1.8	3.7	3.2	2.2	3.3	1.2	1.6	5.7	7.9
Fourth quartile	1,970	61.0	5.8	2.0	1.5	4.3	3.3	2.2	2.9	1.6	2.0	6.6	6.8

Source: Based on data collected by the International Food Policy Research Institute, Philippines National Nutrition Council, and the Philippines Ministry of Agriculture, "Pilot Food Subsidy Survey, 1983/84," Philippines.

overall food consumption and the increasing relative importance of such calorie sources as bread, cooking oil, sugar, beef, pork, poultry, milk, and eggs. Although the poorest income group, as expected, derived the highest proportion of total calories from rice and maize, their diet was surprisingly high in fish, fruits, and vegetables. One possible explanation is that the lowest income group receives a relatively higher proportion of their nonstaple foods as wages (such as fish) or as gifts from neighbors (backyard produce of fruits and vegetables).

The share of calories from cooking oil for the highest income quartile was almost twice that of the lowest income group. The same trend can be observed for milk, eggs, pork, beef, and bread.

It appears that the 24-hour food weighing method overestimated the consumption of rice and underestimated the consumption of virtually all other commodities. This pattern was consistent for all population groups. As a consequence, the relative importance of rice in the diet is much lower if food acquisition data are used.

The difference between food acquisition and food consumption data is large for sugar, fruits and vegetables, and other foods.[17] It is conceivable that these commodities played a more important role in weekend meals and therefore were underrepresented in the 24-hour weighing. Or, sugar used in food preparation and in coffee may not have been fully accounted for in the food weighing, which focused on the main meals. Finally, fruits and vegetables consumed between meals may not have been fully reflected in the food weighing.

Maize acquired under flexible period recall is reported to be more than twice the amount of maize consumed under 24-hour weighing. This difference can be traced almost totally to maize in Abra, which was estimated to be 125 calories per AEU per day using the weighing method and 318 calories per AEU per day using recall. There is no obvious explanation for this difference.

Individual Calorie Intake and Adequacy

For a subsample composed of 140 households, individual food consumption data were collected, using a combination of techniques. Food weighing and observation techniques were used in determining intrafamilial distribution of food, while the recall method was used in determining food consumed outside the home. Data were collected for every member of the household over a 24-hour period, and the survey was repeated for the same households and members four times during the study period.

To assess whether a person consumed an amount more, less, or equal to the average calorie requirement, the study compares the calories consumed with the Philippine RDA for calories.[18] Table 11 provides data on calorie intake and calorie adequacy ratios (intake divided by require ments) by sex and age group for each of the four population quartiles. The mean calorie intake of preschool children was far below requirements, particularly for females, who obtained only 50 to 55 percent of their requirements. Male preschool children, although better off than their female counterparts, still consumed much less than the norm. The difference between adequacy rates for male and female preschoolers is statistically significant at the 5 percent level.

The calorie adequacy of adults above 18 years of age was higher than that for children and adolescents. There was no significant difference between the husbands' and wives' calorie adequacy, except when the wives were pregnant or lactating. Women who were pregnant or lactating at the time of the survey had adequacy ratios of 0.69 compared to 0.78 for all wives and

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[17] Such differences were also found in Egypt. See Harold Alderman and Joachim von Braun, *The Effects of the Egyptian Food Ration and Subsidy System on Income Distribution and Consumption,* Research Report 45 (Washington, D.C.: International Food Policy Research Institute, 1984).

[18] Philippines, National Nutrition Council, Nutrition Research Committee, *Philippine Recommended Dietary Allowances, Part I, Nutrients* (Manila: National Nutrition Council, 1976).

Table 11—Calorie intakes of groups of individual household members

		First Income Quartile			Second Income Quartile			Third Income Quartile		
Gender	Age	Daily Calorie Intake	Calorie Adequacy	Number of Observations[a]	Daily Calorie Intake	Calorie Adequacy	Number of Observations[a]	Daily Calorie Intake	Calorie Adequacy	Number of Observations[a]
	(years)		(percent)			(percent)			(percent)	
Male	1 – 6	873	0.59	115	877	0.61	89	817	0.59	114
Male	7 – 12	1,221	0.65	27	1,355	0.70	39	1,364	0.70	74
Male	13 – 18	1,675	0.67	16	1,520	0.60	29	1,356	0.53	28
Male	19 – 39	1,906	0.74	109	2,055	0.80	91	1,942	0.75	122
Male	40 – 64	1,986	0.83	19	2,074	0.86	23	2,118	0.89	33
Male	65 and older	1,914	0.97	5	968	0.52	3	2,251	1.14	6
Female	1 – 6	711	0.52	128	797	0.56	104	818	0.55	140
Female	7 – 12	1,114	0.58	52	1,197	0.62	71	1,171	0.61	81
Female	13 – 18	1,263	0.58	11	1,353	0.62	20	1,189	0.60	26
Female	19 – 39	1,607	0.73	123	1,648	0.76	100	1,581	0.75	141
Female	40 – 64	1,438	0.78	28	1,519	0.88	26	1,618	0.93	41
Female	65 and older	1,235	0.90	10	1,270	0.90	15	1,582	1.09	6
Male (household head)		1,955	0.77	116	2,117	0.84	98	2,032	0.81	130
Female (spouse)		1,591	0.73	134	1,598	0.76	110	1,625	0.80	143
Pregnant or lactating women		1,606	0.68	90	1,704	0.72	59	1,589	0.68	69

		Fourth Income Quartile			Total for Entire Sample		
Gender	Age	Daily Calorie Intake	Calorie Adequacy	Number of Observations[a]	Daily Calorie Intake	Calorie Adequacy	Number of Observations[a]
	(years)		(percent)			(percent)	
Male	1 – 6	902	0.63	125	868	0.60	443
Male	7 – 12	1,368	0.69	97	1,348	0.69	237
Male	13 – 18	1,374	0.55	32	1,455	0.58	105
Male	19 – 39	1,880	0.73	88	1,944	0.75	410
Male	40 – 64	1,969	0.82	41	2,035	0.85	116
Male	65 and older	1,717	0.88	11	1,795	0.92	25

(continued)

Table 11—Continued

Female	1–6	858	0.59	111	794	0.55	483
Female	7–12	1,197	0.64	65	1,173	0.61	269
Female	13–18	1,350	0.63	37	1,324	0.61	94
Female	19–39	1,682	0.81	132	1,628	0.76	496
Female	40–64	1,364	0.76	39	1,487	0.84	134
Female	65 and older	1,577	1.11	12	1,377	0.98	43
Male (household head)		2,020	0.80	101	2,028	0.80	445
Female (spouse)		1,691	0.83	135	2,152	0.78	522
Pregnant lactating women		1,737	0.72	47	1,646	0.69	265

Source: Based on data collected by the International Food Policy Research Institute. Philippines National Nutrition Council, and the Philippines Ministry of Agriculture, "Pilot Food Subsidy Survey, 1983/84," Philippines.

Note: These are data from the four survey rounds combined.

[a] The number of observations is the number of persons times the number of interviews of each person.

0.80 for husbands. Again, the calorie adequacy rate tended to rise as household income increased for most groups. The patterns observed in this study essentially conform to those observed in other regions in the Philippines.[19]

These findings suggest that in order to reach nutritionally vulnerable household members, targeting households with malnourished preschoolers may be inadequate. School-age children and adolescents, particularly females, were as deficient in calories as preschoolers.

Nutritional Status of Preschool Children

Anthropometric data for all preschool children in the sample households provide the basis for determining their nutritional well-being relative to a particular growth standard. Four indicators of nutritional status are reported in Table 12: mean weight as a percent of standard, proportion of children below 75 percent of standard weight-for-age, proportion below 60 percent, and Z-scores of weight-for-age. Although a local Philippine weight standard is available, this portion of the study uses international standards developed by the National Center for Health Statistics of the United States in order to facilitate international comparisons of results.

Results reveal that one of every four children in the study areas is malnourished to either the second or third degree (less than the 75 percent cutoff suggested in the Gomez classification system). Malnutrition appears to have been higher in the province of Antique than in the two other sample provinces. The data suggest that malnutrition declined dramatically from 34 to 18 percent during the 17 months between the first and last survey round. The improvement in child weight relative to the standard is also reflected in the mean weight-for-age, which increased from 80.7 to 85.0 percent. The Z-scores for weight-for-age are also consistent with nutritional improvement during the period.

The incidence of child malnutrition varied according to the occupational group of the parents. The highest percentage of malnourished children belonged to families of hired fishermen (40 percent), boat-owning fishermen (30 percent), tenant farmers of nonfood crops (28 percent), maize farmers (24 percent), wage earners (23 percent), and landless farm laborers (22 percent). The groups that were relatively well off were the children of professionals and salaried workers and landowning rice farmers—the occupational groups with the highest incomes (see Table 6). These results indicate that income and sources of income are factors that account for differences in nutritional status across occupational groups. The analysis of nutritional level by income group also bears out this observation. It shows that 15.9 percent of children in the highest income quartile were malnourished, compared with 29.8 percent of children belonging to the lowest income quartile. Z-scores of weight-for-age and mean weight-for-age show similar improvements as income increases.

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[19] Robert E. Evenson, Barry M. Popkin, and Elizabeth K. Quizon, "Nutrition, Work and Demographic Behavior in Rural Philippine Households," in *Rural Households in Asia,* ed. Hans B. Binswanger et al. (Singapore: Singapore University Press, 1980); Melba B. Aligaen and Cecilia A. Florencio, "Intra-Household Nutrient Distribution and Adequacy of Food and Nutrient Intake of Filipino Urban Households," *Philippine Journal of Nutrition* (January-March 1980): 11-19; and Rosario Valenzuela, "A Study on Nutrient Distribution within the Family and Factors Affecting Nutrient Intake," University of the Philippines, Diliman, 1977 (mimeographed).

Table 12—Nutritional status of preschool children, 1983-84

Category	Number of Observations	Mean Weight as a Percent of Standard Weight-for-Age	Mean Z-Scores of Weight-for-Age	Percentage of Malnourished Children: Second Degree[a]	Percentage of Malnourished Children: Third Degree[b]
		(percent)		(percent)	
Entire sample[c]	3.053	83.12	−1.64	23.16	1.84
Province[c]					
Abra	803	83.85	−1.58	20.33	1.00
Antique	1,336	82.71	−1.71	26.24	1.81
South Cotabato	914	83.09	−1.60	20.85	2.65
Survey round					
May 1983	768	80.74	−1.87	29.88	4.42
November 1983	766	83.18	−1.66	24.40	1.36
May 1984	770	83.90	−1.57	20.99	0.53
November 1984	749	85.03	−1.47	16.82	0.90
Occupational categories[c]					
Rice farmer landowner	194	86.28	−1.33	20.27	1.72
Maize farmer landowner	228	82.97	−1.70	22.92	3.65
Farmer, other crops	83	84.94	−1.48	17.14	0.95
Tenant rice farmer	94	82.37	−1.70	22.56	0.00
Tenant maize farmer	138	84.22	−1.43	18.01	1.90
Tenant, other crops	53	80.97	−1.82	27.06	1.18
Landless farm laborer	258	83.47	−1.63	21.54	1.03
Wage earner	801	83.09	−1.64	22.05	1.78
Professional/salaried	100	86.53	−1.31	14.87	1.03
Fishermen, boat owners	410	81.23	−1.87	30.63	2.38
Hired fishermen	35	80.03	−2.03	41.42	2.86
Employed overseas	233	83.86	−1.63	20.94	0.49
Occupation unclassified	426	82.75	−1.64	24.78	2.83
Income group[c]					
First quartile (lowest)	763	81.35	−1.84	29.20	2.92
Second quartile	763	82.06	−1.73	26.35	1.80
Third quartile	763	83.40	−1.64	21.98	1.49
Fourth quartile	764	86.07	−1.34	14.86	1.19

Source: Based on data collected by the International Food Policy Research Institute, Philippines National Nutrition Council, and the Philippines Ministry of Agriculture, "Pilot Food Subsidy Survey, 1983/84," Philippines.

Note: The z-score is a method used in standardizing the distribution of actual weight of the child relative to the standard weight for a child of that sex and age. The standards devised by the U.S. National Center for Health Statistics (NCHS) were used in the study.

[a] Second-degree malnutrition includes those children between 60 and 75 percent of the standard weight-for-age.

[b] Third-degree malnutrition includes children weighing less than 60 percent of the standard weight-for-age.

[c] These data are for all survey rounds combined.

7

A COMPARATIVE ANALYSIS OF THE EFFECTS OF THE FOOD PRICE SUBSIDY SCHEME

In this chapter the effects of each of the two components of the scheme—price subsidy and nutrition education—are estimated based on direct comparisons between households that received these components and households that did not. As explained earlier, the first survey round was done before the scheme was implemented and the fourth round after the scheme was completed. To avoid the effects of seasonal variations, the third round was done exactly one year after the first and the fourth round one year after the second. Thus, a direct comparison between rounds one and three should yield an estimate of the impact of the scheme provided no other changes took place during the year that influenced the outcome variable. But such changes may have occurred. Therefore a control subsample—one that was not a part of the scheme—is needed. Assuming that any external changes were the same for the control subsample and the subsample participating in the scheme, these external effects can be isolated from the effects of the scheme.

This is the approach used here. Means for control and treatment groups for each survey round and means for survey rounds one and three and two and four were tested statistically for significant differences. Then the changes in the treatment groups from the price subsidy and the nutrition education program were estimated using the methods presented in Chapter 5. Estimates are provided for the impact on household food expenditures, calorie acquisition, and calorie consumption, as well as calorie adequacy of groups of individuals, and mean weight and height for age of preschoolers.

Household Food Expenditures

Household food expenditures increased greatly for all household groups because food prices rose steeply during the study period (Table 13). The increase was larger for households receiving the subsidy, that is, about 9 percent—approximately the size of the subsidy—after the scheme had been in effect for 10 months (Table 14). These households continued to spend more on food after the scheme was discontinued. Households receiving both the subsidy and nutrition education showed the largest increase, but nutrition education without the subsidy does not seem to have influenced food expenditures. Clearly, enhancement of purchasing power of the poor and improvement of their nutrition-related knowledge are strongly complementary. The effect of one is greatly influenced by the presence of the other.

Household Food Acquisition

Household calorie acquisition increased with the introduction of the subsidy and fell back almost to presubsidy levels when the subsidy was discontinued (Table 15). Households receiving the subsidy increased their daily calorie acquisition by about 250 calories per AEU, while the calories acquired by households in the control group actually declined by almost 30 calories per AEU per day. On the assumption that this fall was caused by factors (primarily price increases) that also influenced the subsidized households, the impact of the subsidy was judged to be about 280 calories per AEU per day, including the decrease avoided. Thus, households receiving the subsidy acquired about 19 percent more calories than they would have without the subsidy (Table 16). Although food acquisition fell when the scheme ended, it was still about 11 percent above prescheme levels after adjusting for effects of external factors. Thus, it appears that the

Table 13—Weekly food expenditures for each subsample and survey round

	Survey Round				Levels at Which Means are Significantly Different[a]	
Subsample/Levels of Significance	1	2	3	4	Between Rounds 1 and 3	Between Rounds 2 and 4
Subsample receiving subsidy	20.0	24.2	36.5	34.0	0.001	0.001
With nutrition education	20.4	25.0	36.6	34.2	0.001	0.001
Without nutrition education	19.5	23.3	36.3	33.7	0.001	0.001
Subsample not receiving subsidy	20.4	21.9	34.2	32.9	0.001	0.001
With nutrition education	21.4	22.5	35.8	34.6	0.001	0.001
Without nutrition education	19.4	21.3	32.3	31.3	0.001	0.001
Subsample receiving nutrition education	20.9	23.8	36.2	34.4	0.001	0.001
Subsample receiving no nutrition education	19.5	22.3	34.5	32.5	0.001	0.001
Levels at which means are significantly different[a]						
Subsidy versus no subsidy						
Total sample	n.s.	0.001	0.05	n.s.	0.001	0.001
Subsample receiving nutrition education	n.s.	0.005	n.s.	n.s.	0.001	0.001
Subsample receiving no nutrition education	n.s.	0.05	0.05	0.05	0.001	0.001
Nutrition education versus nutrition education	0.01	n.s.	n.s.	0.05	0.001	0.001

Source: Based on data collected by the International Food Policy Research Institute, Philippines National Nutrition Council, and the Philippines Ministry of Agriculture, "Pilot Food Subsidy Survey, 1983/84," Philippines.

[a] Significance is based on t-test; n.s. means not significant at the 0.10 level.

Table 14—Change in household food expenditures due to price subsidy or nutrition education

	Time of Measurement		
Scheme	Two Months After Initiation of Scheme	Ten Months After Initiation of Scheme	Two Months After Termination of Scheme
		(percent)	
Subsidy versus no subsidy			
Total sample	12.7	8.9	5.4
Subsample receiving nutrition education	16.6	7.2	3.7
Subsample receiving no nutrition education	8.8	11.8	7.1
Nutrition education versus no nutrition education	−0.4	−2.1	−1.2

Source: Based on data collected by the International Food Policy Research Institute, Philippines National Nutrition Council, and the Philippines Ministry of Agriculture, "Pilot Food Subsidy Survey, 1983/84," Philippines.

Notes: Percentages of change in food expenditures are in comparison to the baseline and corrected for exogenous changes reflected in the control sample. Changes are estimated on the basis of direct comparisons between control and treatment populations. The value of the subsidy was 9.25 percent of food expenditures of households receiving subsidies in survey round 2 and 8.5 percent in round 3.

Table 15—Daily calorie acquisition for each subsample and survey round

Subsample/Levels of Significance	Survey Round				Levels at Which Means are Significantly Different	
	1	2	3	4	Between Rounds 1 and 3	Between Rounds 2 and 4
Subsample receiving subsidy	1,742	2,038	2,009	1,788	0.001	0.001
With nutrition education	1,798	2,063	2,029	1,746	0.001	0.001
Without nutrition education	1,686	2,013	1,989	1,831	0.001	0.001
Subsample not receiving subsidy	1,836	1,793	1,802	1,710	n.s.	0.050
With nutrition education	1,889	1,844	1,873	1,778	n.s.	0.050
Without nutrition education	1,784	1,742	1,731	1,643	n.s.	n.s.
Subsample receiving nutrition education	1,844	1,954	1,951	1,762	0.050	0.001
Subsample receiving no nutrition education	1,735	1,878	1,860	1,737	n.s.	0.005
Levels at which means are significantly different						
Subsidy versus no subsidy						
Total sample	0.050	0.001	0.001	0.050		
Subsample receiving nutrition education	n.s.	0.001	0.005	n.s.		
Subsample receiving no nutrition education	n.s.	0.001	0.001	0.001		
Nutrition education versus no nutrition education	n.s.	n.s.	0.005	n.s.		

Source: Based on data collected by the International Food Policy Research Institute, Philippines National Nutrition Council, and the Philippines Ministry of Agriculture, "Pilot Food Subsidy Survey, 1983/84," Philippines.

Note: Levels of significance are based on t-test; n.s. means not significant at the 0.10 level.

Table 16—Change in daily calorie acquisition due to price subsidy or nutrition education

Scheme	Time of Measurement		
	Two Months After Initiation of Scheme	Ten Months After Initiation of Scheme	Two Months After Termination of Scheme
		(percent)	
Subsidy versus no subsidy			
Total sample	20.9	18.6	11.2
Subsample receiving nutrition education	17.8	14.0	3.4
Subsample receiving no nutrition education	21.6	21.0	17.3
Nutrition education versus no nutrition education	−2.1	−1.3	−4.6

Source: Based on data collected by the International Food Policy Research Institute, Philippines National Nutrition Council, and the Philippines Ministry of Agriculture, "Pilot Food Subsidy Survey, 1983/84," Philippines.

Notes: Percentages of change are in comparison to the baseline and corrected for exogenous changes reflected in the control sample. Changes are estimated on the basis of direct comparisons between control and treatment populations.

scheme had a long-term effect on food acquisition over and above the effect of the income transfer itself. This effect does not seem to originate with nutritional education, which, if anything, had a negative effect on calorie acquisition.

Household Calorie Consumption

According to data from 24-hour food weighing, household calorie consumption by subsidized households increased slightly, although these changes were not statistically significant. During the same period, calories consumed by nonsubsidized households decreased significantly (Table 17). Thus it appears that the subsidy effectively countered a decrease stemming from other factors and resulted in calorie consumption about 10 percent above what it would have been without the subsidy (Table 18). The negative effects of external factors are fully reflected in the calorie consumption of the subsidized households after the scheme was discontinued. Whereas consumption levels of the two groups were significantly different during the latter part of the scheme, this difference disappeared as soon as the scheme was terminated, leaving both groups consuming less than before. Nutrition education appears to have had little or no effect on calorie consumption as measured by 24-hour food weighing.

Calorie Consumption by Individuals

The calorie adequacy rate increased during the period of the subsidy and fell after the subsidy was terminated for virtually all members of subsidized households (Tables 19 and 20). But adult males and females appear to have gained considerably more from the scheme than children. Some of the adults' relative gain seems to have been maintained after the scheme was discontinued. However, school-aged children, who did gain some from the scheme, were considerably worse off after the scheme was terminated than before it was initiated. There is no obvious explanation for this phenomenon.

Table 17—Daily household calorie consumption for each subsample and survey round

					Levels at Which Means are Significantly Different	
	Survey Round				Between Rounds 1 and 3	Between Rounds 2 and 4
Subsample/Levels of Significance	1	2	3	4		
Subsample receiving subsidy	1,741	1,676	1,788	1,651	n.s.	n.s.
With nutrition education	1,724	1,669	1,804	1,613	0.050	n.s.
Without nutrition education	1,757	1,684	1,772	1,688	n.s.	n.s.
Subsample not receiving subsidy	1,751	1,763	1,639	1,689	0.001	0.050
With nutrition education	1,791	1,814	1,636	1,717	0.001	n.s.
Without nutrition education	1,710	1,710	1,641	1,661	n.s.	n.s.
Subsample receiving nutrition education	1,738	1,742	1,720	1,665	n.s.	0.050
Subsample receiving no nutrition education	1,734	1,697	1,707	1,675	n.s.	n.s.
Levels at which means are significantly different						
Subsidy versus no subsidy						
Total sample	n.s.	0.050	0.001	n.s.		
Subsample receiving nutrition education	n.s.	0.005	0.001	0.050		
Subsample receiving no nutrition education	n.s.	n.s.	0.001	n.s.		
Nutrition education versus no nutrition education	n.s.	n.s.	n.s.	n.s.		

Source: Based on data collected by the International Food Policy Research Institute, Philippines National Nutrition Council, and the Philippines Ministry of Agriculture, "Pilot Food Subsidy Survey, 1983/84," Philippines.

Notes: Levels of significance are based on t-test; n.s. means not significant at the 0.10 level.

Table 18—Change in daily household calorie consumption due to price subsidy or nutrition education

Scheme	Time of Measurement: Two Months After Initiation of Scheme	Ten Months After Initiation of Scheme	Two Months After Termination of Scheme
		(percent)	
Subsidy versus no subsidy			
Total sample	−4.4	9.7	−1.7
Subsample receiving nutrition education	−4.4	14.5	−2.4
Subsample receiving no nutrition education	−4.2	5.9	−1.1
Nutrition education versus no nutrition education	2.4	0.5	−0.8

Source: Based on data collected by the International Food Policy Research Institute, Philippines National Nutrition Council, and the Philippines Ministry of Agriculture, "Pilot Food Subsidy Survey, 1983/84," Philippines.

Notes: Percentages of change are in comparison to the baseline and corrected for exogenous changes reflected in the control sample. Changes are estimated on the basis of direct comparisons between control and treatment populations.

According to this measurement, nutrition education had a significant and positive effect on the calorie adequacy of most groups, especially pregnant and lactating women, when provided along with food subsidies. No impact is detected when nutrition education was provided alone, confirming once again the importance of providing nutrition education together with expanded purchasing power.

Nutritional Status

The weight-for-age of the preschoolers in the sample relative to standard weight-for-age increased during the study period (Table 21). The increase was largest for preschoolers in the households that participated in the subsidy scheme (Table 22). Based on these comparisons, it may be concluded that the scheme improved the average weight of the preschoolers relative to the standards. The effects continued for at least two months beyond the termination of the scheme. Nutrition education does not appear to have contributed to these improvements.

Table 23 shows changes in the height-for-age of the preschoolers studied. A general increasing trend was found in all groups. The increase was slightly larger among preschoolers from subsidized households. Thus, it appears that the scheme caused an increase in height of 2.7 percent during the first 10 months of its existence. The effect was slightly higher in the group receiving both subsidy and nutrition education than in those receiving only one of those components (Table 24).

Table 19—Individual calorie adequacy by age and gender for each subsample and survey round

Survey Round/ Sample	Adults					Children				All	
				All > 14 Years		1-7 Years		7-14 Years			
	Husbands	Wives	Pregnant/ Lactating Women	Male	Female	Male	Female	Male	Female	Male	Female
					(percent)						
Survey round 1											
Subsidized											
With education	0.73	0.78	0.65	0.75	0.79	0.55	0.56	0.66	0.61	0.67	0.66
Without education	0.70	0.74	0.70	0.73	0.78	0.60	0.57	0.72	0.77	0.67	0.69
Nonsubsidized											
With education	0.96	0.88	0.71	0.90	0.81	0.55	0.57	0.64	0.59	0.73	0.71
Without education	0.85	0.71	0.56	0.74	0.69	0.67	0.46	0.64	0.51	0.69	0.59
Survey round 2											
Subsidized											
With education	0.88	0.86	0.76	0.85	0.86	0.63	0.62	0.65	0.68	0.73	0.73
Without education	0.78	0.87	0.77	0.79	0.82	0.62	0.61	0.65	0.65	0.68	0.71
Nonsubsidized											
With education	0.85	0.78	0.67	0.79	0.76	0.56	0.53	0.69	0.55	0.68	0.63
Without education	0.68	0.72	0.60	0.62	0.69	0.60	0.38	0.41	0.47	0.58	0.55
Survey round 3											
Subsidized											
With education	0.88	0.84	0.79	0.82	0.85	0.66	0.61	0.72	0.69	0.74	0.73
Without education	0.82	0.82	0.77	0.81	0.85	0.60	0.62	0.61	0.56	0.68	0.72
Nonsubsidized											
With education	0.77	0.76	0.73	0.75	0.77	0.55	0.54	0.66	0.55	0.66	0.66
Without education	0.80	0.76	0.62	0.69	0.71	0.62	0.54	0.65	0.58	0.65	0.63
Survey round 4											
Subsidized											
With education	0.72	0.80	0.71	0.68	0.80	0.65	0.52	0.61	0.52	0.66	0.64
Without education	0.70	0.74	0.72	0.72	0.80	0.71	0.67	0.68	0.58	0.70	0.70
Nonsubsidized											
With education	0.85	0.80	0.71	0.81	0.77	0.60	0.62	0.74	0.64	0.71	0.69
Without education	0.88	0.76	0.71	0.82	0.76	0.68	0.45	0.72	0.71	0.72	0.64

Source: Based on data collected by the International Food Policy Research Institute, Philippines National Nutrition Council, and the Philippines Ministry of Agriculture, "Pilot Food Subsidy Survey, 1983/84," Philippines.

Table 20—Change in calorie adequacy for selected groups of individuals due to price subsidy or nutrition education

Scheme	Husbands			Wives			Adult Males			Adult Females		
	a	b	c	a	b	c	a	b	c	a	b	c
	(percent)											
Subsidy versus no subsidy												
Total sample	36.4	37.9	5.8	20.7	15.0	3.9	28.0	26.2	−5.4	9.2	9.1	−1.4
Subsample receiving nutrition education	36.2	50.3	11.4	24.4	24.7	12.8	29.1	31.2	0.7	16.0	13.2	6.5
Subsample receiving no nutrition education	39.3	24.5	−3.4	15.9	3.5	−6.6	29.2	19.0	−11.0	5.1	5.9	−6.9
Nutrition education versus no nutrition education (total sample)	9.4	−6.0	−8.2	−9.9	−10.9	−6.2	3.0	−6.1	−13.2	−1.4	−3.9	−6.3

Scheme	Pregnant or Lactating Women			Male Children 1-7 Years			Female Children 1-7 Years		
	a	b	c	a	b	c	a	b	c
	(percent)								
Subsidy versus no subsidy									
Total sample	13.2	8.0	−4.6	14.2	12.3	11.8	23.0	4.7	1.4
Subsample receiving nutrition education	23.9	18.2	9.2	12.5	20.0	8.3	19.1	15.0	−14.6
Subsample receiving no nutrition education	2.7	−0.7	−18.9	15.4	8.1	16.6	29.6	−7.3	20.2
Nutrition education versus no nutrition education (total sample)	−3.3	0.6	−8.6	14.5	16.4	4.7	5.8	−8.8	−7.1

Scheme	Male Children 8-14 Years			Female Children 8-14 Years			All Males			All Females		
	a	b	c	a	b	c	a	b	c	a	b	c
	(percent)											
Subsidy versus no subsidy												
Total sample	9.6	−5.8	−17.4	4.7	−11.9	−35.5	19.4	13.4	0.1	16.7	7.4	−7.3
Subsample receiving nutrition education	−8.7	5.8	−20.1	19.6	21.3	−21.4	17.0	22.2	1.3	24.7	19.0	−0.2

(continued)

Table 20—Continued

Subsample receiving no nutrition education	40.9	−16.6	−16.1	−8.4	−36.1	−45.9	20.7	7.7	0.1	10.4	−2.3	−6.5
Nutrition education versus no nutrition education (total sample)	32.3	14.6	1.6	18.1	16.0	−4.8	9.5	1.5	−5.6	0.1	−4.5	−7.3

Source: Based on data collected by the International Food Policy Research Institute, Philippines National Nutrition Council, and the Philippines Ministry of Agriculture, "Pilot Food Subsidy Survey, 1983/84," Philippines.

Notes: Percentage of change in food expenditures are in comparison to the baseline and corrected for exogenous changes reflected in the control sample. Changes are estimated on the basis of direct comparisons between control and treatment populations. The value of the subsidy was 9.25 percent of food expenditures of households receiving subsidies in survey round 2 and 8.5 percent in round 3. a is the survey round 2 months after initiation of the scheme; b is the survey round 10 months after initiation of the scheme; and c is the survey round 2 months after termination of the scheme.

Table 21—Mean weight-for-age of all preschoolers for each subsample and survey round

	Survey Round				Levels at Which Means are Significantly Different	
Subsample/Levels of Significance	1	2	3	4	Between Rounds 1 and 3	Between Rounds 2 and 4
	(percent)					
Subsample receiving subsidy	77.3	81.2	84.4	84.9	0.001	0.001
With nutrition education	79.9	81.5	83.9	85.3	0.001	0.005
Without nutrition education	74.4	80.9	85.1	84.6	0.001	0.005
Subsample not receiving subsidy	84.3	84.2	82.2	83.3	n.s.	n.s.
With nutrition education	82.8	81.6	81.0	81.6	n.s.	n.s.
Without nutrition education	85.7	86.4	83.4	84.9	0.050	0.050
Subsample receiving nutrition education	80.4	81.0	82.7	83.7	0.001	0.010
Subsample receiving no nutrition education	81.4	83.5	84.2	84.6	0.001	0.001
Levels at which means are significantly different						
Subsidy versus no subsidy						
Total sample	0.05	n.s.	0.005	0.005		
Subsample receiving nutrition education	0.05	n.s.	n.s.	0.050		
Subsample receiving no nutrition education	n.s.	n.s.	0.005	0.050		
Nutrition education versus no nutrition education	n.s.	n.s.	n.s.	n.s.		

Source: Based on data collected by the International Food Policy Research Institute, Philippines National Nutrition Council, and the Philippines Ministry of Agriculture, "Pilot Food Subsidy Survey, 1983/84," Philippines.

Notes: Levels of significance are based on t-test; n.s. means not significant at 0.10 level.

Table 22—Change in weight-for-age of preschoolers due to price subsidy or nutrition education

	Time of Measurement		
Scheme	Two Months After Initiation of Scheme	Ten Months After Initiation of Scheme	Two Months After Termination of Scheme
		(percent)	
Subsidy versus no subsidy			
Total sample	5.3	12.1	11.3
Subsample receiving nutrition education	3.5	7.3	8.3
Subsample receiving no nutrition education	8.0	17.4	14.9
Nutrition education versus no nutrition education	−1.7	0.7	−0.3

Source: Based on data collected by the International Food Policy Research Institute, Philippines National Nutrition Council, and the Philippines Ministry of Agriculture, "Pilot Food Subsidy Survey, 1983/84," Philippines.

Notes: Percentages of change are in comparison to the baseline and corrected for exogenous changes reflected in the control sample. Changes are estimated on the basis of direct comparisons between control and treatment populations.

Table 23—Mean height-for-age of all preschoolers for each subsample and survey round

Subsample/Levels of Significance	Survey Round				Levels at Which Means are Significantly Different	
	1	2	3	4	Between Rounds 1 and 3	Between Rounds 2 and 4
	(percent)					
Subsample receiving subsidy	89.8	91.3	93.4	93.2	0.001	0.001
With nutrition education	89.2	90.7	93.7	93.0	0.001	0.005
Without nutrition education	90.7	91.9	93.2	93.3	0.010	n.s.
Subsample not receiving subsidy	91.8	92.0	93.0	92.4	0.050	n.s.
With nutrition education	92.8	93.4	94.7	94.4	0.050	n.s.
Without nutrition education	90.9	90.8	91.4	90.7	n.s.	n.s.
Subsample receiving nutrition education	90.7	91.8	94.1	93.6	0.001	0.010
Subsample receiving no nutrition education	90.8	91.4	92.4	92.2	0.010	n.s.
Levels at which means are significantly different						
Subsidy versus no subsidy						
Total sample	0.005	n.s.	n.s.	n.s.		
Subsample receiving nutrition education	0.001	0.001	n.s.	n.s.		
Subsample receiving no nutrition education	n.s.	n.s.	0.050	0.001		
Nutrition education versus no nutrition education	n.s.	n.s.	0.010	0.050		

Source: Based on data collected by the International Food Policy Research Institute, Philippines National Nutrition Council, and the Philippines Ministry of Agriculture, "Pilot Food Subsidy Survey, 1983/84," Philippines.

Notes: Levels of significance are based on t-test; n.s. means not significant at the 0.10 level.

Table 24—Change in height-for-age of preschoolers due to price subsidy or nutrition education

Scheme	Time of Measurement		
	Two Months After Initiation of Scheme	Ten Months After Initiation of Scheme	Two Months After Termination of Scheme
		(percent)	
Subsidy versus no subsidy			
Total sample	1.4	2.7	3.1
Subsample receiving nutrition education	1.0	2.9	2.5
Subsample receiving no nutrition education	1.4	2.2	3.1
Nutrition education versus no nutrition education	0.5	2.0	1.6

Notes: Percentages of change are in comparison to the baseline and corrected for exogenous changes reflected in the control sample. Changes are estimated on the basis of direct comparisons between control and treatment populations.

8

A MULTIVARIATE ANALYSIS OF THE EFFECTS OF THE FOOD SUBSIDY SCHEME

Direct static comparisons may not yield reliable results because the effects of the scheme are not effectively separated from the effects of other factors.[20] Therefore, in this chapter comparative analysis is supplemented with empirical results of multivariate analysis, employing the analytical methodology presented in Chapter 5.

A comparison of the food consumption patterns between the first (baseline) survey and the subsequent survey rounds indicates that the rationed subsidies for rice were inframarginal for about 90 percent of the recipient households. On average, rice acquisition per capita was estimated at 118 kilograms annually before the subsidy was introduced, whereas the per capita ration was only 60 kilograms per year. For cooking oil, however, the rationed quantity was extramarginal. On average, per capita intake of cooking oil was about 2.20 kilograms per year, while the subsidized quantity was estimated at 4.70 kilograms per year.

Effects on Household Food Expenditures and Calorie Acquisition

The parameters of equation (3) in Chapter 5 are estimated by ordinary least squares from the pooled sample from the four survey rounds. The regression results are reported in the Appendix, Table 34, and the parameter estimates for the key variables are summarized in Table 25. The estimated price and income elasticities and the MPCs are reported in Table 26. As shown in Table 25, changes in household income significantly affected both food expenditures and calorie acquisition. Furthermore, the subsidy seems to have had an impact on these household variables over and above the effect expected from the real income embodied in the subsidy. Changes in the price of rice did not have a significant effect on either food expenditures or calorie acquisition. Changes in the price of cooking oil affected food expenditures as well as calorie acquisition significantly. No significant effect of the nutrition education component of the scheme was detected.

The estimated income elasticity for total food expenditures, which was about 0.68, is in the plausible range and is similar to those obtained in studies of Sri Lanka (0.72), Thailand (0.65), Egypt (0.69), and Bangladesh (0.67).[21] The calorie acquisition elasticity of 0.33 is about half of the food expenditure elasticity, indicating that even poor rural households have a tendency to shift to higher-priced sources of calories as incomes increase.[22] Thus, the average increase in household incomes of 8.0 percent brought about by the rice and oil subsidy is estimated to have caused an increase of 5.6 percent

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[20] Per Pinstrup-Andersen, "An Analytical Framework for Assessing Nutrition Effects of Policies and Programs," *Food Policy,* ed. Charles K. Mann and Barbara Huddleston (Bloomington: Indiana University Press, 1985), pp. 55-66.

[21] David E. Sahn, "Malnutrition and Food Consumption in Sri Lanka: An Analysis of Changes from 1969 to 1982," International Food Policy Research Institute, Washington, D.C., 1986 (mimeographed); Trairatvorakul, *Effects on Income Distribution and Nutrition;* Alderman and von Braun, *Effects of the Egyptian Food Ration and Subsidy System;* and Odin K. Knudsen and Pasquale L. Scandizzo, *Nutrition and Food Needs in Developing Countries,* Staff Working Paper 328 (Washington, D.C.: World Bank, 1979).

[22] This value is about the same as the average estimated by Alderman for a number of countries (Harold Alderman, *The Effect of Food Price and Income Changes on the Acquisition of Food by Low-Income Households* [Washington, D.C.: International Food Policy Research Institute, 1986]).

Table 25—Key coefficients for household food expenditure and food acquisition regressions

Independent Variable	Dependent Variable			
	Household Food Expenditures		Household Calorie Acquisition	
	Model A-1	Model A-2	Model B-1	Model B-2
	(pesos/AEU/day)		(calories/AEU/day)	
Log income	2.20 (57.82)[a]	2.16 (56.72)[a]	633.29 (27.37)[a]	623.07 (27.00)[a]
Subsidy	0.03 (7.30)[a]	0.16 (4.96)[a]	8.94 (3.32)[a]	68.23 (3.34)[a]
Price of rice	0.006 (0.37)	0.006 (0.34)	−12.11 (−1.12)	−12.22 (1.12)
Price of cooking oil	0.012 (4.11)[a]	0.004 (1.49)	−5.98 (3.51)[b]	−7.45 (5.14)[a]
Nutrition education	−0.02 (−0.73)	−0.02 (−0.86)	22.67 (1.28)	21.86 (1.24)
Regression R^2	0.73	0.72	0.38	0.38
N	2,509	2,509	2,509	2,509

Notes: The adult equivalent unit (AEU) is a method used to convert the consumption of persons of different ages and sex to standard consumption units. The complete set of coefficients is given in the Appendix, Table 34. The figures in parentheses are t-ratios.

[a] Significant at the 5 percent level.

[b] Significant at the 10 percent level.

in total food expenditures and 2.6 percent in calorie acquisition if the income transfer from the subsidy is treated the same as other income.

The estimated price elasticities for rice of −0.006 to −0.020 and −0.020 to −0.050 for cooking oil seem low, but these should not be confused with own-price elasticities. The price elasticities shown in Table 26 are price elasticities for total food expenditures and total calories, and they show the net effect after substitutions among commodities have taken place. Therefore, they would be expected to be lower than direct price elasticities for individual foods.

One of the issues addressed in this study—whether the subsidy scheme influences household food consumption over and above the effect of the income transfer as measured by the income elasticity above—is tested and evaluated using two different model specifications (see Chapter 5). As reported in Table 25, the subsidy component of the pilot scheme positively affects both household food expenditures and calorie acquisition: it is highly significant. The effect detected by the subsidy term is over and above the price and income effects. The effect of the nutrition education component of the pilot scheme is weak but positive. Although significant at only a 0.20 level, it appears important as a complementary intervention in the scheme. To further explore the effects of nutrition education on households, interaction between nutrition education and the subsidy—that is, both schemes operating simultaneously—are tested in regressions. Such tests indicate no differential effects of nutrition education-subsidy interaction on calorie and food acquisition.

The estimates of absolute effects can be gleaned from the MPCs and the price and income elasticities. The MPC results show that an additional P 1.00 of subsidy income would add P 0.69-0.98 to food expenditures. The 0.50 MPC for expenditures on food from all income sources other than subsidies is within the range usually found in poor rural areas in the developing world.

Table 26—Parameters for estimating the impact of the pilot subsidy scheme on household food expenditures and calorie acquisition

Independent Variable	Dependent Variable			
	Household Food Expenditures		Household Calorie Acquisition	
	Model A-1	Model A-2	Model B-1	Model B-2
Marginal propensity to consume				
All income net of subsidy	0.50[a]	0.53[a]	142[b]	153[b]
Subsidy income	0.98[a]	0.69[a]	363[b]	222[b]
Consumption parameters				
Income elasticity (net of subsidy)	0.66	0.70	0.32	0.34
Rice price elasticity	−0.01	−0.01	−0.02	−0.02
Oil price elasticity	−0.04	−0.04	−0.04	−0.04
Nutrition education effects	0.02	0.02	22.67	21.86

Notes: See the Appendix, Table 34, for a complete set of regression coefficients. The adult equivalent unit (AEU) is a method used to convert the consumption of persons of different ages and sex into standard consumption units.

[a] Pesos per AEU per day.

[b] Calories per AEU per day.

The difference in the MPC between cash and subsidy incomes is also large for calories. Thus, the marginal propensity to increase calorie consumption from subsidy income is about twice that of the MPC for all other sources of income. In absolute terms, every additional peso of subsidy increases calorie consumption by 222-363 calories per AEU. The impact of an additional peso of other income is about 150 calories per AEU.

Different MPCs for different sources of household income have also been found in other studies of consumption behavior in both developed and developing countries. In Kerala, India, there is evidence that participation in rice subsidy programs increased the MPCs of some households.[23] Several studies on the consumption effect of food stamps on U.S. households indicate that the MPC for subsidy transfer is twice to three times that of the MPC for money income.[24]

The behavioral change that caused a higher MPC for subsidy income cannot be fully explained. Perhaps the scheme generated an increased awareness among participants about food and nutrition needs over and above the explicit nutrition education intervention that accompanied the price subsidy. It is conceivable that mothers' awareness of the nutritional objectives of the scheme helped realign family budget priorities. In the pilot scheme, there was a strong persuasive element introduced by efforts to draw mothers into nutrition education classes administered by the extension workers.

Another plausible explanation is that the use of rice and oil as the food commodities in the scheme altered food budgets in such a way that the caloric content per unit of the household's food bundle was increased. Per capita daily calories acquired from rice increased from 326 grams prior to the subsidy to 423 grams when the subsidy was in force. Daily calories acquired from cooking oil increased by 30 percent. This raised the MPC for calories for some of the families. The calorie density per kilogram of rice and oil is about twice that of foods in the average food bundle of the study households. Thus, in designing a project it is important to consider not only the economic value of the subsidized good but also its nutritive value if the program is to be nutritionally effective.

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[23] Shubh Kumar, *The Impact of Subsidized Rice on Food Consumption and Nutrition in Kerala*, Research Report 5 (Washington, D.C.: International Food Policy Research Institute, 1979).

[24] Senauer and Young, "Impact of Food Stamps on Food Expenditures."

Evaluated at their mean values, the total energy increase from the scheme is equivalent to 136-138 calories per AEU per day. This calorie effect combines net income effects, price effects, and effects caused by higher MPCs for subsidy. The scheme's total impact on calories is equivalent to 7 percent of the calories consumed per person in the study households. In terms of food expenditures, the scheme effectively increased total food budgets by P 0.27-0.34 per AEU per day, basically the same as the average transfer value of the subsidy, which was P 0.31 per AEU per day.

Household income can be influenced by decisions regarding the allocation of time of each household member to various activities, including income earning. Food subsidies may cause a change in time allocation in general and in the allocation of time to income-earning activities in particular. Thus, it may be hypothesized that the subsidies reduced the time allocated to income-earning activities. This implies substitution between the real income embodied in the subsidies and household income from other sources.

Such substitution is ignored in the models used here and, if it is significant, the models overestimate the effect of the subsidies. To explore whether such a substitution occurred, the household income variable was replaced by predicted wage rates for the husband and wife of each household, and the models were rerun. Neither the size of the coefficient of the subsidy variable nor its level of significance changed appreciably. Furthermore, when the number of hours worked in income-earning activities and household incomes excluding the subsidy value were regressed on the value of the subsidy and a set of other variables, no significant effect of the subsidy on hours worked or household incomes from sources other than the subsidies was detected. Thus, it appears that the use of household incomes as an explanatory variable is acceptable for estimating the effect of the scheme.

Effects of Other Factors

The regression of food expenditures on household size gives negative and significant results, indicating that the presence of more family members reduces food consumption per AEU. Household size is generally more closely related to food expenditures than to calorie acquisition.

The education of the wife is strongly correlated with food expenditures, after controlling for incomes and nutrition education: the more educated the wife, the more she is likely to spend on food for the household. Perhaps she purchases more expensive calories, such as processed foods, because the opportunity cost of time spent on food preparation increases with education. Or perhaps higher education leads to a better understanding of the importance of adequate nutrition. Evidence from Nicaragua and elsewhere indicates that women's schooling plays a substantial role in family nutrition.[25] Higher education of the husband does not appear to affect food expenditures or calorie acquisition significantly.

Participation in food assistance programs such as those administered by Catholic Relief Services, CARE, and the World Food Programme significantly affected food expenditures and calorie acquisition among the study households (Appendix Table 34). The quantities received by households from such programs are not included in the estimates of total food expenditures or calories, and the significant and negative sign demonstrates that food from these programs was substituted for food from other sources.

The regressions show that a large share of total household income earned by women is associated positively with food expenditures and negatively with calorie acquisition (Appendix Table 34). This is consistent with the hypothesis that households where the opportunity cost of women's time is high tend to purchase more expensive calories—such as processed foods—to reduce food preparation time.

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[25] Jere Behrman and Barbara Wolfe, "More Evidence on Nutrition Demand: Income Seems Overrated and Women's Schooling Underemphasized," *Journal of Development Economics* 14 (January-February 1984): 105-128.

The degree to which households supply their own food is partly captured by the OWNFARM and OWNGARDEN variables. These variables significantly and positively affect calorie acquisition. The positive sign on total calorie effects indicates that households with a higher ratio of own-produce, all things being equal, tend to acquire more calories. Under the definition the calorie acquisition term covers calories from both purchased and own-produced foods.

Effects on Consumption of Rice, Oil, Fish, and Maize

The subsidy component of the scheme had a positive and significant effect on the consumption of rice, oil, and fish and a negative effect on the consumption of maize (Table 27). The MPC for rice from total household income, excluding the subsidy, is estimated to be 88 calories or slightly more than one-half of the MPC for total calories. The MPC from subsidy income is 210 calories compared to 220 for total calories. Thus, the increase in total calorie consumption brought about by the subsidy is almost totally accounted for by increasing rice consumption. The MPC for oil is 20 calories from the subsidy and 8 calories from other incomes.

The income elasticity is estimated to be about 0.2 for rice, 0.4 for oil, and 0.5 for fish, while it is negative but nonsignificant for maize. Own-price elasticities for rice and maize are negative but not significantly different from zero. Own-price elasticities for oil and fish are estimated to be about −0.6 and −0.8, respectively. Thus, price subsidies for extramarginal quantities of oil would be expected to increase oil consumption by 6 percent for each 10 percent reduction in its price. The nutrition education component of the scheme appears to have had a positive and significant impact on rice consumption.

Effects on Calorie Consumption by Preschool Children

As reported in Table 28 and in the Appendix, Table 36, calorie demand equations for individual preschoolers yielded statistically significant coefficients for the income and subsidy variables.

The scheme resulted in an additional effect on calories consumed by preschoolers over and above the effect operating through increases in the households' incomes and calorie consumption. This may be partly explained by the families' increased awareness of the nutritional problems of children. The regular monitoring of children's weights, conducted as part of the experiment, may have increased the mothers' awareness, especially since the nutrition education campaign stressed the importance of correct child feeding practices.

According to the demand models, the impact of the pilot scheme on daily calorie consumption of preschoolers between ages 13 and 83 months was 31-55 calories per child—about 3 to 6 percent of the average calorie intake of preschoolers in the sample. These figures are below the average estimated for the household both in absolute terms and relative to individual calorie requirements. For the household, the average effects per AEU were in the neighborhood of 136-138 calories per day.

Effects on the Nutritional Status of Children

Whether the calorie increases for preschool children resulting from the subsidy scheme translated into child growth is a critical question from a policy standpoint. An increase in calorie consumption may be viewed not as a measure of the ultimate outcome of policy, but rather as a measure of an intermediate outcome. This distinction is often critical in measuring the impact of a program. Indexes of child health and nutritional well-being are considered by many to be important indicators of current economic welfare of developing countries. It is one set of measures of the quality of

Table 27—Key coefficients and parameters for estimating the impact of the pilot subsidy scheme on the acquisition of rice, maize, oil, and fish

	Dependent Variable: Calorie Acquisition Per AEU Per Day			
Independent Variable	**Rice**	**Maize**	**Oil**	**Fish**
Log income per AEU				
(including subsidy)	333.13	−32.67	28.55	39.64
	(9.29)[a]	(−0.96)	(6.50)[a]	(6.14)[a]
Dummy for subsidy	122.02	−104.79	12.22	52.40
	(3.89)[a]	(−3.53)[a]	(3.18)[a]	(9.27)[a]
Price of rice	−5.81	33.87	−1.62	4.10
	(−0.35)	(2.15)[a]	(−0.79)	(1.37)
Price of maize	7.89	−11.12	0.54	0.22
	(0.65)	(−0.97)	(0.36)	(0.10)
Price of oil	−10.66	7.97	−4.22	−0.77
	(−4.76)[b]	(3.77)[a]	(−15.41)[a]	(−1.90)[b]
Price of fish	−3.90	−5.51	−0.43	−7.57
	(−1.23)	(−1.82)	(−1.09)	(−13.20)[a]
Nutrition education	78.14	14.92	3.01	−4.27
	(2.28)[a]	(0.58)	(0.91)	(−0.88)
R^2	0.15	0.16	0.23	0.34
Number of observations	2,131	2,131	2,131	2,131
Marginal propensity to consume[c]				
All incomes (net of subsidy)	88	−9	8	10
Subsidy income	210	−113	20	63
Consumption parameters				
Income elasticity (net of subsidy)	0.23	−0.18	0.38	0.52
Price elasticity				
Rice	−0.01	0.55	−0.06	0.16
Maize	3.0×10^{-4}	−0.004	4.0×10^{-4}	1.7×10^{-4}
Oil	−0.08	0.49	−0.62	−0.11
Fish	−0.02	−0.24	−0.05	−0.78
Nutrition education effects	78.14[a]	14.92	3.01	−4.27
Impact of subsidy on acquisition (calories per AEU per day)	227	−108	15	56

Notes: The numbers in parentheses are t-values. The adult equivalent unit (AEU) is a method used to convert the consumption of persons of different ages and sex into standard consumption units.

[a] Significant at the 5 percent level.

[b] Significant at the 10 percent level.

[c] Calories per AEU per peso.

life, which is itself a policy objective. A child's good health and nutritional status significantly influence his or her intelligence, health, and nutritional status as an adult and have a direct impact on adult productivity and earnings.[26]

The current state of knowledge on how to measure the effects of an intervention program on child nutritional status is quite poor, partly because of the difficulty in modeling the interactions among biological, behavioral, cultural, environmental, and socioeconomic factors that influence the nutritional status and health of children. It is quite possible, for example, that an increase in calories may increase energy

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[26] Barbara Wolfe and Jere Behrman, "Determinants of Child Mortality, Health, and Nutrition in a Developing Country," *Journal of Development Economics* 11 (No. 1, 1982): 163-193.

Table 28—Regressions of calorie intake of children aged 13 to 83 months

	Dependent Variable: Calorie Intake Per Day			
Independent Variable	**Model A-1**	**Model A-2**	**Model B-1**	**Model B-2**
Log income per AEU per day	140.39 (3.64)[a]	129.05 (3.35)[a]	. . .	. . .
Household calorie acquisition per AEU per day	. . .	. . .	0.10 (3.34)[a]	0.09 (3.02)[a]
Subsidy	11.34 (3.64)[a]	100.27 (3.31)[a]	9.87 (2.87)[a]	88.35 (2.87)[a]
Price of rice	68.60 (1.91)[b]	45.87 (1.37)	63.36 (1.76)[b]	43.71 (1.31)
Price of cooking oil	−0.34 (−0.54)	−0.25 (−0.40)	−0.37 (−0.58)	−0.28 (−0.44)
Nutrition education	−55.97 (−1.90)[b]	−55.48 (−1.88)[b]	−62.14 (2.10)[a]	−61.21 (−2.07)[b]
R^2	0.43	0.43	0.43	0.43

Note: See the Appendix, Table 36, for the complete set of regressions. The numbers in parentheses are t-values.
[a] Significant at the 5 percent level.
[b] Significant at the 10 percent level.

expenditures and thereby improve the well-being of the child without changing anthropometry. There are also many measurement problems associated with anthropometric variables. In most cases, regression analyses based on cross-sectional data give very low R^2, indicating an insubstantial knowledge of factors that influence nutritional status or an inability to quantify and incorporate these factors into regression analysis.

The anthropometric data in this study—weight, height, and age of preschool children—were collected monthly from a panel of children from study households prior to and during the time the scheme was in force.

As opposed to the various food-related measures of outcome used in calorie regressions, anthropometric indicators reflect both food- and health-related factors. Thus, the statistical estimate of effect must be able to control for factors such as age, sex, birth order, breast-feeding, morbidity, and child care, which, along with household variables such as family size, education of parents, and accessibility to clean water are expected to influence the nutritional status of preschoolers.

A complete list of the explanatory variables used in the regressions and the estimated coefficients is given in the Appendix, Tables 37 to 41. Table 29 shows the key coefficients for estimating the impact of the scheme, using the five indicators of nutritional status as dependent variables.

Increases in household incomes appear to have a positive effect on all five anthropometric indicators. This effect is highly significant for the short-term indicators, weight and weight-for-age. The subsidy does not seem to influence nutritional status over and above the effect of the income from the subsidy. The nutrition education component of the scheme appears to have had a positive impact on both short- and long-term indicators.

As shown in the Appendix, Tables 37-41, a number of other variables appear to influence the nutritional status of preschoolers. These include diarrhea in the recent past, birth order, access to clean drinking water, and household size.

Table 29—Key coefficients for nutritional status regressions

	Independent Variables					
Dependent Variable	Log Income Per AEU Per Day	Subsidy	Price of Rice	Price of Cooking Oil	Nutrition Education	Regression R^2
Weight						
Percent of total income	0.68	0.03	−0.04	46×10^{-4}	0.25	0.72
	(3.33)[a]	(1.44)	(−0.23)	(1.37)	(1.59)	
Dummy	0.68	−0.12	−0.21	59×10^{-4}	0.21	0.72
	(3.28)[a]	(−0.76)	(−1.17)	(1.77)[b]	(1.30)	
Weight as a percent of standard weight-for-age						
Percent of total income	3.78	0.21	0.30	0.02	2.27	0.14
	(2.77)[a]	(1.71)[b]	(0.23)	(1.08)	(2.17)[b]	
Dummy	3.70	−0.70	−0.92	0.03	1.94	0.14
	(2.70)[a]	(−0.65)	(−0.77)	(1.52)	(1.86)[b]	
Z-scores of weight-for-age						
Percent of total income	0.42	0.03	0.01	87×10^{-5}	0.28	0.12
	(2.43)[a]	(1.97)[a]	(0.06)	(0.31)	(2.08)[a]	
Dummy	0.41	−0.11	−0.17	23×10^{-4}	0.23	0.12
	(2.35)[a]	(−0.79)	(−1.12)	(0.81)	(1.71)[b]	
Z-scores of weight-for-height						
Percent of total income	0.24	0.04	0.43	11×10^{-5}	−0.17	0.11
	(1.40)	(2.48)[b]	(2.68)[b]	(−0.04)	(−1.29)	
Dummy	0.21	0.10	0.28	91×10^{-5}	−0.20	0.10
	(1.25)	(0.75)	(1.87)[b]	(0.33)	(−1.51)	
Height as a percent of standard height-for-age						
Percent of total income	1.11	−0.03	−2.03	−0.02	2.01	0.16
	(1.38)	(−0.37)	(−2.71)[a]	(−1.20)	(3.29)[a]	
Dummy	1.16	−0.82	−2.16	−0.02	1.94	0.17
	(1.45)	(−1.31)	(−3.11)[a]	(−1.33)	(3.17)[a]	

Notes: See the Appendix, Table 36, for the complete set of regressions. The numbers in parentheses are t-values.
[a] Significant at the 5 percent level.
[b] Significant at the 10 percent level.

9

COST-EFFECTIVENESS ANALYSIS

Food price subsidy schemes are but one of many instruments that governments use to alleviate calorie-protein deficiencies and to improve nutrition among poor households. In the Philippines, existing interventions focus on growth monitoring, extension of nutrition education to mothers, and direct supplemental feeding of malnourished children. Several other schemes that are health-related (such as immunization, mother and child health care, oral rehydration) and community-based schemes, such as home and community gardens, have been implemented with varying degrees of cost and effectiveness.[27] Although these interventions have reached a significant proportion of the high-risk population, their impact and relative cost-effectiveness are not clear.

In this chapter the cost-effectiveness of the pilot subsidy scheme will be measured in absolute terms and relative to other nutrition-related intervention programs or policies. Cost comparisons often suffer from lack of adequate data, particularly regarding the net effects of programs. Varying degrees of methodological rigor also make meaningful comparisons among the various types of interventions and programs difficult. For these reasons, the following analysis deals mostly with determining the cost-effectiveness of the scheme itself. Comparative analyses with other nutrition-related interventions will be included to the extent permitted by availability of estimates of the effectiveness of other programs.

Program Cost

The fiscal cost of operating the food price subsidy scheme is given in Table 30. The items reflected are, strictly speaking, government financial or fiscal costs, as they refer to explicit budgetary costs. Economic or implicit costs of the subsidies and the transaction costs incurred by beneficiaries are ignored.

The fiscal cost of the subsidy scheme consists of three main components: the cost of the price subsidy, the cost of the incentive paid to retailers, and the cost of administration and management.

The cost of the price subsidy is computed as the price discount allowed for rice and cooking oil multiplied by the subsidized quantity. The price discount is the difference between the market price and the subsidized price paid by the participating households. As shown in Table 30, this component accounted for about 84 percent of the total fiscal costs. To compensate retailers for added costs, the scheme offered an incentive of 7 percent of the gross sales of the program commodities to the accredited retailers. The reliance of the subsidy scheme on the private trade network for its procurement and distribution effectively saved the government the costs of the provision of warehousing, distribution outlets, and vehicles. The administrative overhead covered salaries and benefits for the extension workers and paraprofessional workers, the cost of travel of monitoring staff, salaries of central office project administration, office overhead, vehicles, and costs of printing the discount cards. It is difficult to estimate the cost of the nutrition education component separately from the administrative overhead for the subsidy operations because extension staff members performed both as subsidy monitoring officers and as nutrition educators. If person-hours were the mea-

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[27] Stewart Blumenfeld et al., *PL 480 Title II: A Study of the Impact of Food Assistance Programs in the Philippines* (Washington, D.C.: U.S. Agency for International Development, 1982).

Table 30—Fiscal costs of the pilot food price subsidy scheme and their distribution

Province/ Subsidy	Cost Per Month				Pilot Population Coverage	Fiscal Cost Per Capita		
	Subsidy Cost	Retailers' Incentive	Administrative Cost	Total Program Cost		Monthly	Annually	Annually
	(pesos)					(pesos)		(U.S. $)
Abra								
Rice and oil	16,595	1,430	1,856	19,881	2,829	7.03	84.36	7.67
	(83.5)	(7.2)	(9.3)	(100.0)				
Antique								
Rice and oil	18,958	1,633	2,001	22,592	2,615	8.64	103.68	9.43
	(83.9)	(7.2)	(8.9)	(100.0)				
Antique								
Oil	4,941	221	1,634	6,796	1,797	3.78	45.36	4.12
	(72.7)	(3.3)	(24.0)	(100.0)				
South Cotabato								
Rice and oil	13,861	1,195	1,686	16,742	1,912	8.76	105.12	9.56
	(82.8)	(7.1)	(10.1)	(100.0)				
Average all areas	49,414	4,258	5,543	59,215	6,816	8.69	104.28	9.48
	(83.4)	(7.2)	(9.4)	(100.0)				

Source: Based on data collected by the International Food Policy Research Institute, Philippines National Nutrition Council, and the Philippines Ministry of Agriculture, "Pilot Food Subsidy Survey, 1983/84," Philippines.

Note: The numbers in parentheses are percentages of the total cost.

sure, however, the extension staff spent 60 percent of project time on subsidy monitoring and 40 percent for nutrition education.

Administrative costs accounted for 9.4 percent of the total cost of the pilot scheme. It is likely that in a national program, several layers of supervisory infrastructure, from the central offices down to the region, province, and village levels, would be necessary. This heavy supervisory infrastructure would likely put pressure on the implementing and coordinating agencies (in this case, the Ministry of Agriculture and the National Nutrition Council). Such burdens are associated with larger fiscal outlays for salaries and office overhead. It is estimated that these outlays would add 25 percent to the administrative costs shown in Table 30.

Cost-Effectiveness Measures

In estimating cost-effectiveness, three main factors are considered: the size of the net program benefits to intended beneficiaries, the extent of leakage associated with the different levels of targeting, and program costs. Estimates of the net effects of the scheme given in Chapter 8 are summarized in Table 31. It must be noted that these estimates are computed at the mean for all participating households and children within these households. The leakage issues have been discussed in Chapter 5 and will not be repeated here.

Cost-effectiveness indicators are developed in this study for alternative program goals. (Estimation procedures are described in Chapter 5.) Therefore, a program design with a goal to improve the nutrition of malnourished preschool children can be compared with a design where the goal is to improve the nutrition of all household members.

Fiscal Cost of Transferring U.S. $1.00

If the goal of the program is to efficiently transfer purchasing power, the fiscal cost of transferring U.S. $1.00 may be an appropri-

Table 31—Estimated net impact of the pilot subsidy scheme on food acquisition and nutrition

Variable	Model	Estimated Net Impact[a]
Household		
Food expenditure	Percent of total income	P 0.27 per AEU per day
	Dummy	P 0.34 per AEU per day
Calorie acquisition	Percent of total income	136 calories per AEU per day
	Dummy	138 calories per AEU per day
Individuals (preschoolers)		
Calorie intake	Percent of total income	31 calories per day
	Dummy	55 calories per day
Weight	Percent of total income	0.12 kilograms
	Dummy	0.14 kilograms

[a] The net impact is computed at the mean.

ate indicator of cost-effectiveness. As discussed in Chapter 5, this indicator is at best a crude measure of cost-effectiveness from a nutritional standpoint because several sources of leakage are present.

The cost of transferring U.S. $1.00 to all households participating in the subsidy scheme is calculated at U.S. $1.19 in 1984 prices (Table 32). This estimate assumes that all participating households are the target of the program. However, some recipient households are not nutritionally deficient. If the definition of the targets includes only those households that consume less than 80 percent of the recommended calories, the fiscal cost of transferring U.S. $1.00 rises to U.S. $1.63 under the assumption that program benefits accruing to households above the 80 percent cutoff constitutes a leakage. It is estimated from the consumption surveys that about 27 percent of the participating households were above the 80 percent cutoff line.

If the goal is to reach only those households with malnourished preschool children, the cost of transferring U.S. $1.00 increases by a factor of three because the extent of leakage from an untargeted program would be high. About one-third of the study households had at least one malnourished child. The rest of the households are considered nontarget under this assumption.

Fiscal Cost of Increasing Food Acquisition by 100 Calories per AEU per Day

If all households in the targeted villages are defined as program beneficiaries, it would cost U.S. $6.75 annually to increase the daily caloric intake by 100 calories per AEU (Table 32). This estimate is based on net impact, as it already accounts for substitution effects (see the discussion in Chapter 8). In order to bring the average calorie acquisition of households in the study areas to recommended levels, it would cost the government about U.S. $25 per AEU per year.

If the program is intended only for households with calorie acquisition of less than 80 percent of the recommended levels, then the subsidy received by households above this cutoff may be considered a leakage in a scheme targeted by area. Given the size of the leakage, it is estimated that it would cost U.S. $7.40 to increase the calorie intake of households below the 80 percent cutoff by 100 calories per AEU per day for one year. If the program goal is to reach only those households with malnourished preschool children, the annual fiscal cost would increase to U.S. $13.66 per AEU, inasmuch as two-thirds of the households do not have malnourished preschool chil-

Table 32—Cost-effectiveness indicators

Indicator	All Participating Households (H_1)	Households Consuming Less Than 80 Percent of RDA (H_2)	Households With Malnourished Children (H_3)	All Participating Preschool Children (C_1)	Preschool Children Consuming Less Than 80 Percent of RDA (C_2)	Malnourished Preschool Children (C_3)
				(U.S. $)		
Fiscal cost of transferring $1.00	1.19	1.63	3.61	n.a.	n.a.	n.a.
Annual fiscal cost per AEU of a net increase in food acquisition of 100 calories per AEU per day	6.75	7.40	13.66	n.a.	n.a.	n.a.
Annual fiscal cost per AEU of eliminating the calorie gap[a]	25.18	27.60	50.95	n.a.	n.a.	n.a.
Annual fiscal cost per preschooler of a net increase of 100 calories per individual preschool child per day	n.a.	n.a.	n.a.	26.00	45.12	74.41
Annual fiscal cost per preschooler of increasing the weight of preschool children by 1 kilogram[b]	n.a.	n.a.	n.a.	76.59	87.31	101.86

Notes: n.a. means not applicable. The adult equivalent unit (AEU) is a method used to convert the consumption of persons of different ages and sex into standard consumption units. Costs are given in 1984 prices.

[a] The mean calorie deficiency in the study households is estimated at 373 calories per AEU per day.

[b] The mean weight of children in the sample was 13.3 kilograms, which on average for all survey rounds is 86.9 percent of standard.

dren; hence, benefits to such households would be considered leakage.

Fiscal Cost of Increasing Preschoolers' Daily Calorie Consumption by 100 Calories

The analysis has shown that preschool children are at great nutritional risk because their share of the family food basket is small relative to their RDA. Hence, it is important to examine the range of cost required to raise their calorie intakes to a particular consumption level.

Based on the impact on calorie consumption for the preschool child derived from the individual demand equations in Chapter 5, it is estimated that it would cost the government U.S. $26 annually to increase the average daily intake of preschoolers by 100 calories per day per preschooler. This figure is roughly four times the cost of achieving the same level (100 calories) of benefit on average for all household members. The higher cost reflects the large share of additional household food consumption that will be captured by members other than preschoolers. The average calorie increment at the household level will also exceed the increment accruing to preschoolers within the same household because the distribution is uneven, and that will also be reflected in the cost.

Not all preschool children within the targeted villages are equally at risk of malnutrition. Some are more predisposed to the problem than others because of the varying amounts of calories consumed. If the scheme's objective is to reach only those children consuming less than 80 percent of RDA, then the benefits accruing to children above this cutoff are considered leakage. This translates to a higher cost: it is estimated that it would cost U.S. $45 per child to increase the daily calorie intake of preschoolers currently below the 80 percent cutoff by 100 calories for a one-year period.

If the program target is defined to include only the malnourished children, then the cost escalates to U.S. $74 per 100 calories because the leakage (benefits accruing to well-nourished children and other household members) is considerably higher.

Fiscal Cost of Increasing the Weight of Preschoolers

The expected effects of the scheme on child weight are summarized in Table 31. A net increment of 0.12 kilograms was the contribution of the scheme to the growth of children between 13-83 months. Such an impact represents 1.0 percent of the average body weight of the sample preschoolers. These estimates are based on actual ex-post data of a continuous and sustained level of participation in the subsidy scheme among the study children.

The incremental weight gain of children reported in Table 31 represents the average net impact produced by the scheme. In order to increase a child's weight by 1 kilogram, it would cost the government U.S. $76 annually. This assumes that all of the children in the study area are program targets. If the goal is to improve the weight of only malnourished children, the fiscal cost of increasing child weight by 1 kilogram increases to U.S. $101, since benefits derived by children who are not malnourished can be considered leakage.

The average weight of the preschool children in the sample was 13.3 kilograms, which is about 2.0 kilograms below the standard weight-for-age. Thus, the above increase of 1 kilogram would reduce the average gap by about one-half.

Improving Cost-Effectiveness

The preceding sections have clearly demonstrated that cost-effectiveness hinges on the method of targeting. The geographic-area targeting scheme that was used in the pilot subsidy scheme provides benefits to all households in the target areas irrespective of nutritional status and food deficiency. This implies that the cost-effectiveness of the scheme could be increased by targeting those households expected to be high-risk. Once the area is identified, a second level of screening of participants could target those households that need the subsidy. According to the cost-effectiveness indicators in Table 32, the cost of increasing the acquisition of a given amount of food by households with at least one malnourished preschooler could be reduced by half if the program were targeted to those households only.

The use of child weight as a targeting criterion may be feasible in the Philippine setting because of the extensive child weighing program carried out nationwide since 1975, called Operation *Timbang*. The use of growth monitoring for targeting would entail the additional cost of periodic weighing. However, this cost is very small and can be disregarded in cost-effectiveness estimates.

It is important to emphasize that targeting a price subsidy scheme is practical only at the household level. The presence of a malnourished child may be used to identify target households, but efforts to target the benefits of the scheme exclusively to the individual child are not likely to be successful.

Cost-Effectiveness Relative to Other Programs

It may be misleading to compare relative cost-effectiveness of alternative programs unless the context in which these programs are evaluated is based on a comparable set of objectives, targeting, coverage, timing of inputs, and duration of program and project organization. Given the state of the art in the evaluation of nutrition and health programs, including the shortage of data, any comparison, at best, can only detect general indications of relative cost-effectiveness.

Relative cost-effectiveness should be evaluated in terms of particular program goals. Hence, if the program goal is to deliver a certain number of calories, the measure of relative cost- effectiveness could give the cost of transferring, say, 1,000 calories. Alternatively, the measure could be given in terms of the cost to deliver U.S. $1.00 worth of subsidy if the concern is income transfer efficiency. However, these are crude measures from the point of view of nutrition because they do not account for leakages (see Chapter 5).

A more refined measure is the fiscal cost of a certain net increase in daily consumption by malnourished individuals. It should, however, be emphasized that in order to get meaningful results, calculations should be based on the net calorie impact, that is, net of substitution effects. However, few available program evaluations estimate substitution.

Cost-effectiveness indicators for several programs are reported in Table 33. The annual fiscal cost of a net increase in calorie consumption by 100 calories per day is available as a net figure only for the Philippine pilot subsidy scheme and for the Sri Lankan food stamp program.[28] The cost-effectiveness measures for other programs reported in Table 33 are estimated on the basis of gross calorie estimates of impact, and thus they overestimate the actual increase in consumption. The costs reported are not strictly comparable, although they give some guidance on relative cost-effectiveness. Except for the Philippine pilot subsidy and Sri Lankan food stamp program, the cost-effectiveness figures for the programs reported do not estimate leakage through sharing and substitution.

The results indicate that the Philippine pilot subsidy scheme is relatively more cost-effective than any of the programs listed in Table 33. The food stamp program in Sri Lanka is almost as cost-effective, but all the other programs are considerably less cost-effective. The cost of a gross transfer of 100 calories per person per day by any of the other programs is more than twice that of the Philippine program. However, these results must be interpreted in a proper context. Each of the programs cited has particular goals and methods of targeting; each uses different food commodities, and each

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[28] Edirisinghe, *The Food Stamp Scheme in Sri Lanka.*

Table 33—Cost-effectiveness comparison with other programs

Program	Annual Cost Per Beneficiary	Food Transfers in Calories Per Person Per Day	Fiscal Cost to Deliver 1,000 Calories	Fiscal Cost to Deliver $1.00 Subsidy	Fiscal Cost of Transferring 100 Calories Per Day Per Person For One Year[a]	Fiscal Cost of a Net Increase of 100 Calories Per Day Per Person For One Year[b]
				(U.S. $)		
Philippines						
Pilot food price subsidy scheme, 1984	9.18	272 (gross)[a] 136 (net)[b]	0.11 (gross) 0.22 (net)	1.19	3.38	6.75
Sri Lanka						
Food stamp, 1982	8.60	228 (gross)[a] 98 (net)[b]	0.10 (gross) 0.24 (net)	n.a.	3.77	8.77
Brazil						
Food subsidy (PINS), 1980	21.32	300[a]	0.30	1.21	7.11	n.a.
Brazil						
Preschool feeding and nutrition education, 1980	46.48	500[a]	0.53	2.38	9.29	n.a.
Colombia						
Food subsidy, 1981	35.04	300[a]	0.79	1.58	11.68	n.a.
Indonesia						
Feeding program, 1982	56.01	n.a.	n.a.	2.48	. . .	n.a.
Mexico						
Milk subsidy, 1983	38.16	248[a]	n.a.	n.a.	15.38	n.a.
Tamil Nadu, India						
Weighing and feeding, 1982	33.10	300[a]	n.a.	1.74	11.03	n.a.
Philippines						
Mother and child health	31.00	n.a.	0.25	n.a.	. . .	n.a.
School feeding	11.50	n.a.	0.42	n.a.	. . .	n.a.
Day care	19.20	n.a.	n.a.	n.a.	. . .	n.a.
Mothercraft center	400.00	n.a.	n.a.	n.a.	. . .	n.a.

Sources: For Sri Lanka, Neville Edirisinghe, *The Food Stamp Scheme in Sri Lanka: Costs, Benefits, and Options for Modification*, Research Report 58 (Washington, D.C.: International Food Policy Research Institute, 1987); for Brazil, Colombia, Indonesia, and India, World Bank, Population, Health, and Nutrition Department, *Nutrition Review* (April 1984); for other programs in the Philippines, S. Blumenfeld et al., *PL 480 Title II: A Study of the Impact of a Food Assistance Program in the Philippines* (Washington, D.C.: U.S. Agency for International Development, 1982); and for Mexico, Eileen Kennedy, C. Overholt, and Lawrence Haddad, "Effect of a Milk Subsidy on Distribution of Benefits Within the Household," International Food Policy Research Institute, Washington, D.C., 1984.

Note: n.a. means not available.

[a] This is the amount of calories transferred if substitution is not accounted for.

[b] This is based on the marginal propensity to consume, accounting for substitution.

is implemented on a different scale. While only pilot programs have been implemented for the Philippine, Colombian, and Brazilian schemes, the Sri Lankan scheme has been in operation for a longer period on a national scale. The Tamil Nadu, India, program is narrowly targeted to malnourished children, while some of the other programs are not. Thus, the cost of transferring a certain amount of calories may not be an appropriate measure of the impact on nutrition.

As expected, the fiscal cost of transferring $1.00 worth of subsidy is determined largely by the degree of targeting. The Philippine scheme, which uses geographical area targeting, shows the lowest cost. The preschool feeding programs in Brazil, Indonesia, and India had the highest cost because these are the most tightly targeted among those reported in Table 33.

Among the factors that contribute to the relatively lower cost of delivery of the Philippine pilot subsidy scheme, the commodity mix is quite important. Besides being locally produced, rice and oil are the cheapest source of calories in the country, and they are available in almost all parts of the country. These foods are bought in raw form, unlike the expensive processed weaning foods used in the Colombian food subsidy program.

Another crucial factor is the substantially lower percentage of administrative costs—about 9.4 percent of the total cost. These costs are low because targeting by geographical area eliminates the burdensome and costly screening of beneficiaries found in some of the other programs. In addition, the administrative costs in the Philippine program are an add-on type of cost because the delivery system is built upon an already existing infrastructure of extension officers.

10

CONCLUSIONS

It is evident that the pilot subsidy scheme was successful in increasing food consumption among participating households. Although distribution of the additional food within the households favored adults, preschool children consumed more calories and showed improvement in their nutritional status. Increases in food consumption came mostly from the increases in purchasing power resulting from the price subsidies on rice and cooking oil. Furthermore, the marginal propensity to spend on food out of the real income embodied in the price subsidies appears to be considerably higher than the marginal propensity to spend on food out of other income. The lower oil prices resulted in substitution of oil for other commodities. Finally, the effects of the nutrition education component were positive and strong for children but weak on the household level.

The scheme resulted in net increases in calories acquired by households of 136-138 calories per AEU per day, which is about 7 percent of current calorie consumption; calorie consumption by preschoolers of 31-55 calories per child per day; and the weight of preschoolers of 0.12-0.14 kilograms. Eighty-four percent of the cost of the scheme was the subsidy itself. Administrative costs accounted for about 9 percent and the incentive payment to retailers to assure efficient distribution of subsidized food was about 7 percent.

The results of the assessment of cost-effectiveness can be summarized as follows. The fiscal cost of each U.S. $1.00 transferred to participating households is estimated to be U.S. $1.19. However, if only the transfers received by households with malnourished preschoolers are considered a benefit, whereas transfers received by other households are considered leakage, the cost increases to U.S. $3.61. Similarly, the annual cost of a net increase in calorie consumption of 100 calories per AEU per day among all households is estimated to be U.S. $6.75 per AEU, increasing to U.S. $13.66 if only food received by households with malnourished preschoolers is considered of interest to the scheme.

The annual cost of eliminating calorie deficiencies in the study population is estimated to be U.S. $25 per AEU. Adding 1 kilogram to the weight of each preschooler is estimated to cost U.S. $76 per year. If only weight gains among the malnourished are counted as benefits, the cost increases to U.S. $101 per year.

Comparisons with other programs show that the cost-effectiveness of the Philippine pilot subsidy scheme was extremely favorable, primarily because costs were kept low through geographical targeting based on growth monitoring, the use of existing private sector retail outlets for the distribution of subsidized foods, and the use and expansion of existing local bureaucratic structures.

If the sole goal of the scheme were to expand food consumption by households with malnourished preschoolers and to improve the nutritional status of these preschoolers, the cost-effectiveness of the scheme would be significantly improved by a two-step targeting procedure based on growth monitoring. The first step would be to identify target villages with a high concentration of underweight preschoolers. This was the approach used in this scheme. The second step would be to target individual households in the selected villages and to remove from the scheme those households that do not include preschoolers at high nutritional risk. According to the estimates here, a second targeting step would reduce the cost of providing benefits to high-risk preschoolers to less than one-half the cost of the scheme when untargeted within the village.

Low calorie adequacy rates among preschoolers, both in absolute terms and relative to the adequacy rates of adults, clearly justify focusing on this age group. However, adequacy rates of school-age children and adolescents were almost as low. Other studies have shown similar results.[29] If this finding is of general validity throughout the country, it raises serious questions about the usefulness of targeting nutrition programs to preschoolers alone. It might be more appropriate to use a two-step targeting procedure based on growth monitoring of all children, not just preschoolers.

A strong relationship between malnutrition and incomes is found in this study. Certain low-income occupational groups—landless farm workers, some wage earners, and tenant farmers, for example—are much more likely to be malnourished than others. This is primarily because their purchasing power is limited. Efforts to expand food consumption and improve the nutritional status of preschoolers in those groups through nutrition education are unlikely to be successful unless accompanied by expanded purchasing power.

Although nutrition education clearly plays a role in expanding food consumption by preschoolers, such expansion is more likely to come about as part of an overall increase in household food consumption. Efforts to reallocate an inadequate amount of food among household members so that preschoolers receive a larger share are unlikely to be successful in households operating under severe income constraints. Furthermore, such reallocation may endanger the survival of the household as a whole by further eroding the income-earning capabilities of economically active adult members who must have enough energy to work productively. However, as this study shows, nutrition education may be effective in assuring that a larger share of additional income is spent on food for the household members most at risk of malnutrition.

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[29] Valenzuela, "Nutrient Distribution Within the Family"; and Aligaen and Florencio, "Intra-Household Nutrient Distribution."

APPENDIX: SUPPLEMENTARY TABLES

Table 34—Regression results for household food expenditures and food acquisition

Independent Variable	Household Food Expenditures Per AEU Per Day		Household Calorie Acquisition Per AEU Per Day	
	Model A-1	Model A-2	Model B-1	Model B-2
Intercept	0.151 (1.39)	0.255 (2.37)	984.29 (14.89)	998.38 (15.35)
Log income per AEU (including subsidy)[a]	2.202 (57.82)	2.167 (56.72)	633.95 (27.38)	623.07 (27.01)
Subsidy in percent of income	0.032 (7.30)	. . .	8.94 (3.32)	. . .
Subsidy dummy	. . .	0.168 (4.96)	. . .	68.23 (3.35)
Log of household size	−0.051 (−7.83)	−0.054 (−7.70)	−5.92 (−1.40)	−5.98 (−1.41)
Education of husband	0.002 (0.49)	0.0004 (0.08)	-5.52) (−1.97)	−6.07 (−2.17)
Education of wife	0.017 (3.63)	0.016 (3.24)	−1.92 (−0.65)	−2.46 (−0.83)
Nutrition education dummy				
PNP[b]	0.023 (0.63)	0.062 (1.68)	−13.68 (−0.61)	−3.76 (−0.17)
Pilot[c]	−0.021 (−0.73)	−0.025 (−0.86)	22.67 (1.29)	21.86 (1.24)
Food assistance dummy	0.056 (1.86)	0.052 (1.73)	39.45 (2.16)	36.26 (1.98)
Percent women's income	0.001 (1.81)	0.001 (1.58)	−1.03 (−2.50)	−1.06 (−2.56)
Price of rice	0.006 (0.37)	0.006 (0.34)	−12.11 (−1.12)	−12.23 (−1.13)
Price of oil	0.012 (4.11)	0.004 (1.49)	−5.98 (−3.51)	−7.45 (−5.14)
Dummy for Antique Province	−0.059 (−1.47)	−0.069 (−1.71)	248.40 (10.18)	245.04 (10.04)
Dummy for South Cotabato Province	−0.135 (−3.75)	−0.110 (−3.05)	26.96 (1.23)	33.06 (1.52)
Own-farm dummy	0.013 (0.40)	0.009 (0.28)	98.46 (5.02)	98.79 (5.03)
Own-garden dummy	−0.035 (−1.06)	−0.009 (−0.28)	27.50 (1.36)	33.17 (1.66)
F	378.65	371.77	87.19	87.21
R^2	0.73	0.72	0.38	0.38

Notes: Figures in parentheses are t-ratios. The number of observations for each model was 2,509. Models A-1 and B-1 specify the subsidy variable in terms of the proportion of subsidy to total income; Models A-2 and B-2 specify the subsidy variable in terms of a zero-one dummy for the presence of subsidy.

[a] Income is approximated by total expenditures in all regressions.

[b] This dummy is for the Philippine Nutrition Program (PNP), a government program begun in 1974.

[c] This dummy is for the nutrition education program held in conjunction with the pilot food price subsidy study.

Table 35—Regression results for acquisition of rice, maize, oil, and fish

Independent Variable	Rice	Maize	Oil	Fish
	(calories/AEU/day)			
Intercept	785.36 (6.28)	319.63 (2.70)	112.72 (7.37)	82.13 (3.65)
Log income per AEU (including subsidy)[a]	333.13 (9.29)	−32.67 (−0.96)	28.55 (6.50)	39.64 (6.14)
Subsidy dummy	122.02 (3.89)	−104.79 (−3.53)	12.22 (3.18)	52.40 (9.27)
Log of household size	87.08 (2.03)	−6.23 (−0.15)	−24.97 (−4.76)	−40.08 (−5.19)
Education of husband	−8.94 (−2.07)	−1.71 (−0.42)	0.51 (0.97)	−2.51 (−3.22)
Education of wife	−6.50 (−1.43)	2.02 (0.47)	0.95 (1.71)	1.11 (1.36)
Nutrition education dummy				
PNP[b]	78.14 (2.88)	14.92 (0.58)	3.01 (0.91)	−4.27 (−0.88)
Pilot[c]	17.50 (0.51)	100.36 (3.10)	7.33 (1.75)	8.88 (1.44)
Food assistance dummy	105.44 (3.73)	−49.04 (−1.83)	−2.63 (−0.76)	8.41 (1.65)
Percent women's income	−0.59 (−0.92)	−1.22 (−2.04)	−0.01 (−0.16)	−0.22 (−1.90)
Price of rice	−5.81 (−0.35)	33.87 (2.15)	−1.62 (−0.79)	4.10 (1.37)
Price of maize	7.89 (0.65)	−11.12 (−0.97)	0.54 (0.36)	0.22 (0.10)
Price of oil	−10.66 (−4.76)	7.97 (3.77)	−4.22 (−15.41)	0.77 (1.90)
Price of fish	−3.90 (−1.23)	−5.51 (−1.83)	−0.43 (−1.09)	−7.57 (−13.20)
Dummy for Antique Province	331.52 (8.04)	−446.72 (−11.46)	−0.11 (−0.02)	101.19 (13.63)
Dummy for South Cotabato Province	62.12 (1.83)	−485.15 (−15.14)	10.99 (2.65)	9.22 (1.51)
Own-farm dummy	73.92 (2.45)	80.98 (2.83)	−1.65 (−0.45)	−7.07 (−1.30)
Own-garden dummy	13.15 (0.43)	61.95 (2.11)	−3.16 (−0.84)	−4.89 (−0.88)
F	21.56	23.41	36.95	65.01
R^2	0.15	0.16	0.23	0.34

Note: Figures in parentheses are t-ratios. The number of observations was 2,132.

[a] Income is approximated by total expenditures in all regressions.

[b] This dummy is for the Philippine Nutrition Program (PNP), a government program begun in 1974.

[c] This dummy is for the nutrition education program held in conjunction with the pilot food price subsidy study.

Table 36—Regression results for calorie intake of children aged 13 to 83 months

Independent Variable	Model A-1	Model A-2	Model B-1	Model B-2
Intercept	−948.70 (−4.78)	−843.35 (−4.40)	849.39 (−4.41)	−761.75 (−4.07)
Log income per AEU (including subsidy)[a]	140.39 (3.64)	129.05 (3.35)	. . .	. . .
Subsidy in percent of income	11.34 (3.31)	. . .	9.87 (2.87)	. . .
Subsidy dummy	. . .	100.27 (3.31)	. . .	88.35 (2.87)
Education of husband	−9.74 (−2.39)	−10.54 (−2.58)	−8.23 (−2.04)	−9.03 (−2.23)
Education of wife	−4.52 (−0.97)	−6.50 (−1.39)	−4.16 (−0.89)	−5.88 (−1.27)
Sex of child	122.02 (4.50)	124.95 (4.61)	122.49 (4.51)	125.06 (4.61)
Log age in months	395.59 (12.04)	391.57 (11.88)	395.70 (12.01)	392.18 (11.87)
Currently breastfed dummy	70.54 (1.72)	65.58 (1.60)	64.81 (1.58)	60.78 (1.48)
Past breastfed dummy	−75.53 (−1.91)	−71.10 (−1.81)	−72.90 (−1.84)	−69.33 (−1.76)
Nutrition education dummy				
PNP[b]	−42.74 (−1.19)	−45.75 (−1.27)	−36.16 (−1.01)	−39.20 (−1.09)
Pilot[c]	−55.97 (−1.90)	−55.48 (−1.88)	−62.14 (−2.10)	−61.21 (−2.07)
Child care time in hours of wife	−0.36 (−0.30)	−0.21 (−0.17)	0.16 (0.13)	0.25 (0.21)
Diarrhea dummy	−38.44 (−0.86)	−29.93 (−0.67)	−41.55 (−0.92)	−33.75 (−0.75)
Fever dummy	−79.91 (−2.50)	−68.32 (−2.15)	−67.55 (−2.12)	−58.18 (−1.84)
Food assistance dummy	20.69 (0.72)	20.14 (0.70)	4.97 (0.17)	5.71 (0.20)
Percent children below 6 years	1.47 (1.41)	1.00 (0.97)	1.31 (1.25)	0.91 (0.88)
Dummy for Antique Province	211.60 (4.73)	207.82 (4.65)	168.44 (3.79)	168.41 (3.79)
Dummy for South Cotabato Province	−37.98 (−1.06)	−29.04 (−0.81)	−52.03 (−1.45)	−43.13 (−1.21)
Birth order	−19.34 (−1.15)	−23.82 (−1.41)	−16.43 (−0.97)	−20.61 (−1.22)
Water quality dummy	55.24 (1.81)	43.06 (1.40)	60.94 (2.00)	49.91 (1.63)
Household size	−1.95 (0.11)	−4.05 (−0.23)	−10.19 (−0.59)	−7.50 (−0.43)

(continued)

Table 36—Continued

Independent Variable	Model A-1	Model A-2	Model B-1	Model B-2
Percent women's income	0.02 (0.02)	−0.13 (−0.14)	0.10 (0.11)	−0.04 (−0.04)
Price of rice	−68.60 (−1.91)	−45.87 (−1.37)	−63.36 (−1.76)	−43.71 (−1.31)
Price of cooking oil	−0.34 (−0.54)	−0.25 (−0.40)	−0.36 (−0.58)	−0.28 (−0.44)
Household calorie acquisition	. . .	. . .	0.10 (3.34)	0.09 (3.02)
F	15.84	15.84	15.69	15.68
R^2	0.43	0.43	0.43	0.43

Notes: Figures in parentheses are t-ratios. The number of observations for each model was 2,509. Models A-1 and B-1 specify the subsidy variable in terms of the proportion of subsidy to total income; Models A-2 and B-2 specify the subsidy variable in terms of a zero-one dummy for the presence of subsidy.

[a] Income is approximated by total expenditures in all regressions.

[b] This dummy is for the Philippine Nutrition Program (PNP), a government program begun in 1974.

[c] This dummy is for the nutrition education program held in conjunction with the pilot food price subsidy study.

Table 37—Regression results for weight of children aged 13 to 83 months

Independent Variable	Proportional Model	Zero-One Dummy Model
Intercept	−5.80 (−5.49)	−5.27 (−5.15)
Log income per AEU (including subsidy)[a]	0.68 (3.33)	0.68 (3.28)
Subsidy in percent of income	0.03 (1.44)	. . .
Subsidy dummy	. . .	−0.13 (−0.76)
Education of husband	0.0024 (0.11)	−0.0041 (0.19)
Education of wife	0.03 (1.04)	0.03 (1.04)
Sex of child	1.01 (7.00)	1.02 (7.05)
Log age in months	4.41 (25.11)	4.44 (25.16)
Currently breastfed dummy	−0.19 (−0.86)	−0.21 (−0.93)
Past breastfed dummy	−0.51 (−2.42)	−0.43 (−2.04)
Nutrition education dummy		
PNP[b]	0.02 (0.09)	0.05 (0.25)
Pilot[c]	0.25 (1.59)	0.21 (1.30)

(continued)

Table 37—Continued

Independent Variable	Proportional Model	Zero-One Dummy Model
Child care time in hours of wife	0.004 (0.06)	−0.00005 (−0.08)
Diarrhea dummy	−0.47 (−1.96)	−0.48 (−2.01)
Fever dummy	−0.16 (−0.91)	−0.12 (−0.73)
Food assistance dummy	0.0029 (0.02)	0.04 (0.25)
Percent children below 6 years	−0.0037 (−0.66)	−0.0051 (−0.92)
Dummy for Antique Province	−0.36 (−1.52)	−0.37 (−1.57)
Dummy for South Cotabato Province	−0.07 (−0.39)	−0.06 (−0.30)
Birth order	−0.35 (−3.89)	−0.35 (−3.88)
Water quality dummy	−0.48 (−2.96)	−0.47 (−2.83)
Household size	−0.44 (−4.73)	−0.44 (−4.62)
Price of rice	−0.04 (−0.23)	−0.21 (−1.17)
Price of cooking oil	−0.0046 (−1.37)	−0.0059 (−1.77)
F	56.51	56.27
R^2	0.72	0.72

Notes: Figures in parentheses are t-ratios. The number of observations was 509. The proportional model specifies the subsidy variable as a proportion of the subsidy to total income, whereas the dummy model specifies one for the presence of the subsidy, zero otherwise.

[a] Income is approximated by total expenditures in all regressions.

[b] This dummy is for the Philippine Nutrition Program (PNP), a government program begun in 1974.

[c] This dummy is for the nutrition education program held in conjunction with the pilot food price subsidy scheme.

Table 38—Regression results for weight as a percent of standard weight-for-age, children aged 13 to 83 months

Independent Variable	Proportional Model	Zero-One Dummy Model
Intercept	87.35 (12.45)	91.34 (13.42)
Log income per AEU (including subsidy)[a]	3.78 (2.77)	3.70 (2.70)
Subsidy in percent of income	0.21 (1.71)	. . .
Subsidy dummy	. . .	−0.70 (−0.65)

(continued)

Table 38—Continued

Independent Variable	Proportional Model	Zero-One Dummy Model
Education of husband	0.04 (0.25)	0.05 (0.33)
Education of wife	0.22 (1.34)	0.22 (1.31)
Sex of child	1.77 (1.84)	1.83 (1.90)
Log age in months	−5.47 (−4.69)	−5.27 (−4.49)
Currently breastfed dummy	0.40 (0.27)	0.27 (0.18)
Past breastfed dummy	−4.38 (−3.13)	−3.80 (−2.72)
Nutrition education dummy		
PNP[b]	0.20 (0.16)	0.41 (0.32)
Pilot[c]	2.26 (2.17)	1.94 (1.85)
Child care time in hours of wife	0.0076 (0.18)	0.0012 (0.03)
Diarrhea dummy	−3.35 (−2.10)	−3.44 (−2.15)
Fever dummy	−0.54 (−0.47)	−0.29 (−0.26)
Food assistance dummy	0.04 (0.04)	0.29 (0.29)
Percent children below 6 years	−0.002 (−0.05)	−0.01 (−0.35)
Dummy for Antique Province	−2.39 (−1.53)	−2.49 (−1.59)
Dummy for South Cotabato Province	−0.02 (−0.01)	0.12 (0.10)
Birth order	−1.91 (−3.19)	−1.91 (−3.19)
Water quality dummy	−2.94 (−2.71)	−2.84 (−2.59)
Household size	−2.60 (−4.17)	−2.54 (−4.06)
Price of rice	−0.30 (−0.23)	−0.92 (−0.77)
Price of cooking oil	−0.02 (−1.08)	−0.03 (−1.52)
F	3.66	3.52
R^2	0.14	0.14

Notes: Figures in parentheses are t-ratios. The number of observations was 509. The proportional model specifies the subsidy variable as a proportion of the subsidy to total income, whereas the dummy model specifies one for the presence of subsidy, zero otherwise.

[a] Income is approximated by total expenditures in all regressions.

[b] This dummy is for the Philippine Nutrition Program (PNP), a government program begun in 1974.

[c] This dummy is for the nutrition education program held in conjunction with the pilot food price subsidy scheme.

Table 39—Regression results for height as a percent of standard height-for-age, children aged 13 to 83 months

Independent Variable	Proportional Model	Zero-One Dummy Model
Intercept	100.56	100.81
	(24.42)	(25.35)
Log income per AEU (including subsidy)[a]	1.11	1.16
	(1.38)	(1.45)
Subsidy in percent of income	−0.03	. . .
	(−0.37)	
Subsidy dummy	. . .	−0.82
		(−1.31)
Education of husband	0.13	0.13
	(1.50)	(1.59)
Education of wife	0.09	0.11
	(0.97)	(1.09)
Sex of child	0.47	0.46
	(0.83)	(0.82)
Log age in months	−2.29	−2.22
	(−3.35)	(−3.23)
Currently breastfed dummy	−0.53	−0.53
	(−0.63)	(−0.63)
Past breastfed dummy	−1.51	−1.40
	(−1.84)	(−1.72)
Nutrition education dummy		
PNP[b]	0.03	0.10
	(0.04)	(0.13)
Pilot[c]	2.01	1.94
	(3.29)	(3.17)
Child care time in hours of wife	0.01	0.008
	(0.44)	(0.33)
Diarrhea dummy	−1.49	−1.57
	(−1.60)	(−1.68)
Fever dummy	0.19	0.17
	(0.28)	(0.25)
Food assistance dummy	−1.91	−1.85
	(−3.21)	(−3.10)
Percent children below 6 years	0.04	0.04
	(1.66)	(1.71)
Dummy for Antique Province	0.54	0.53
	(0.59)	(0.58)
Dummy for South Cotabato Province	1.38	1.34
	(1.87)	(1.83)
Birth order	−0.50	−0.47
	(−1.43)	(−1.35)
Water quality dummy	−3.07	−2.97
	(−4.84)	(−4.65)
Household size	−0.78	−0.75
	(−2.12)	(−2.05)
Price of rice	−2.03	−2.16
	(−2.71)	(−3.11)

(continued)

Table 39—Continued

Independent Variable	Proportional Model	Zero-One Dummy Model
Price of cooking oil	−0.02 (−1.20)	−0.02 (−1.33)
F	4.32	4.41
R^2	0.16	0.17

Notes: Figures in parentheses are t-ratios. The number of observations was 509. The proportional model specifies the subsidy variable as a proportion of the subsidy to total income, whereas the dummy model specifies one for the presence of the subsidy, zero otherwise.

[a] Income is approximated by total expenditures in all regressions.

[b] This dummy is for the Philippine Nutrition Program (PNP), a government program begun in 1974.

[c] This dummy is for the nutrition education program held in conjunction with the pilot food price subsidy scheme.

Table 40—Regression results for z-scores for weight-for-age, children aged 13 to 83 months

Independent Variable	Proportional Model	Zero-One Dummy Model
Intercept	−1.03 (−1.15)	−0.44 (−0.51)
Log income per AEU (including subsidy)[a]	0.42 (2.42)	0.41 (2.35)
Subsidy in percent of income	0.03 (1.97)	. . .
Subsidy dummy	. . .	−0.11 (−0.79)
Education of husband	0.0099 (0.54)	0.01 (0.62)
Education of wife	0.01 (0.02)	0.01 (0.64)
Sex of child	0.30 (2.46)	0.31 (2.52)
Log age in months	−0.60 (−4.05)	−0.57 (−3.82)
Currently breastfed dummy	−0.04 (−0.24)	−0.06 (−0.34)
Past breastfed dummy	−0.48 (−2.68)	−0.39 (−2.20)
Nutrition education dummy		
PNP[b]	−0.02 (−0.12)	0.01 (0.08)
Pilot[c]	0.28 (2.08)	0.23 (1.71)
Child care time in hours of wife	0.0069 (1.26)	0.0059 (1.07)
Diarrhea dummy	−0.34 (−1.66)	−0.35 (−1.71)

(continued)

Table 40—Continued

Independent Variable	Proportional Model	Zero-One Dummy Model
Fever dummy	−0.10 (−0.69)	−0.06 (−0.44)
Food assistance dummy	0.11 (0.89)	0.15 (1.18)
Percent children below 6 years	−0.004 (−0.77)	−0.005 (−1.11)
Dummy for Antique Province	−0.20 (−1.00)	−0.21 (−1.07)
Dummy for South Cotabato Province	0.19 (1.17)	0.21 (1.30)
Birth order	−0.21 (−2.89)	−0.22 (−2.80)
Water quality dummy	−0.40 (−2.89)	−0.39 (−2.75)
Household size	−0.29 (−3.60)	−0.28 (−3.47)
Price of rice	−0.010 (−0.006)	−0.17 (−1.12)
Price of cooking oil	−0.0009 (−0.31)	−0.0023 (−0.81)
F	3.15	2.98
R^2	0.12	0.12

Notes: Figures in parentheses are t-ratios. The number of observations was 509. The proportional model specifies the subsidy variable as a proportion of the subsidy to total income, whereas the dummy model specifies one for the presence of the subsidy, zero otherwise.

[a] Income is approximated by total expenditures in all regressions.

[b] This dummy is for the Philippine Nutrition Program (PNP), a government program begun in 1974.

[c] This dummy is for the nutrition education program held in conjunction with the pilot food price subsidy scheme.

Table 41—Regression results for z-scores for weight-for-height, children aged 13 to 83 months

Independent Variable	Proportional Model	Zero-One Dummy Model
Intercept	−2.00 (−2.27)	−1.46 (−1.71)
Log income per AEU (including subsidy)[a]	0.24 (1.40)	0.21 (1.25)
Subsidy in percent of income	0.04 (2.48)	. . .
Subsidy dummy	. . .	0.10 (0.75)
Education of husband	−0.02 (−0.95)	−0.02 (−0.97)
Education of wife	0.0076 (0.37)	0.004 (0.20)

(continued)

Table 41—Continued

Independent Variable	Proportional Model	Zero-One Dummy Model
Sex of child	0.14 (1.21)	0.16 (1.29)
Log age in months	-0.09 (-0.63)	-0.08 (-0.55)
Currently breastfed dummy	0.10 (0.53)	0.08 (0.42)
Past breastfed dummy	-0.18 (-1.04)	-0.13 (-0.70)
Nutrition education dummy		
PNP[b]	0.05 (0.29)	0.06 (0.38)
Pilot[c]	-0.17 (-1.29)	-0.20 (-1.51)
Child care time in hours of wife	-0.0029 (-0.54)	-0.003 (-0.59)
Diarrhea dummy	-0.13 (-0.63)	-0.12 (-0.60)
Fever dummy	-0.13 (-0.91)	-0.09 (-0.61)
Food assistance dummy	0.39 (3.03)	0.41 (3.18)
Percent children below 6 years	-0.0079 (-1.70)	-0.01 (-2.10)
Dummy for Antique Province	-0.52 (-2.64)	-0.53 (-2.70)
Dummy for South Cotabato Province	-0.29 (-1.87)	-0.27 (-1.68)
Birth order	-0.16 (-2.13)	-0.17 (-2.21)
Water quality dummy	0.26 (1.92)	0.25 (1.82)
Household size	-0.18 (-2.36)	-0.18 (-2.31)
Price of rice	-0.43 (-2.68)	-0.28 (-1.87)
Price of cooking oil	-0.0001 (-0.04)	-0.0009 (-0.33)
F	2.87	2.58
R^2	0.11	0.10

Notes: Figures in parentheses are t-ratios. The number of observations was 509. The proportional model specifies the subsidy variable as a proportion of the subsidy to total income, whereas the dummy model specifies one for the presence of the subsidy, zero otherwise.

[a] Income is approximated by total expenditures in all regressions.

[b] This dummy is for the Philippine Nutrition Program (PNP), a government program begun in 1974.

[c] This dummy is for the nutrition education program held in conjunction with the pilot food price subsidy scheme.

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RESEARCH REPORT

62

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AGRICULTURAL RESEARCH IN NEPAL: RESOURCE ALLOCATION, STRUCTURE, AND INCENTIVES

Ram P. Yadav

September 1987

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AGRICULTURAL RESEARCH IN NEPAL: RESOURCE ALLOCATION, STRUCTURE, AND INCENTIVES

Ram P. Yadav

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CONTENTS

Foreword

1. Summary 9

2. Introduction 12

3. Agricultural Plan, Policy, and Performance—A Review 14

4. Institutional Development of Agricultural Research 25

5. Allocation of Financial and Personnel Resources for Research 38

6. Research Management and Incentives 50

7. Agricultural Research Priorities and Structure: Some Concluding Observations 59

Appendix 1: Supplementary Tables 65

Appendix 2: Methodology for Determining Growth Rates and Decomposition of Growth Trends 74

Bibliography 75

TABLES

1. Farm size and distribution of cultivated landholdings, 1981 15
2. Annual growth rate of cereal crop area, production, and yield, 1961/62-1980/81 17
3. Per capita food production, 1970/71-1980/81 18
4. Annual growth rate of cereal crop area, production, and yield, by region, 1970/71-1980/81 19
5. Annual growth rate of cash crop area, production, and yield, 1961/62-1980/81 20
6. Annual growth rates (compound) of agricultural production and its components, 1961/62-1980/81 21
7. Annual consumption of chemical fertilizer, 1970/71-1980/81 22
8. Area under high-yielding varieties (HYVs) of wheat, paddy, and maize, 1970/71-1980/81 23
9. Agricultural sector budget expenditures, 1970/71-1980/81 38
10. Budget expenditures on agricultural research and extension and other agricultural items, 1970/71-1980/81 39
11. Agricultural research expenditures, by discipline, 1970/71-1980/81 39
12. Agricultural research expenditures on hill, Tarai, and disciplinary research, 1970/71-1980/81 40
13. Agricultural research expenditures, by region and discipline, 1970/71-1980/81 41
14. Agricultural research expenditure as a share of agricultural GDP and of expenditures on development, agricultural sector, and agriculture, 1970/71-1980/81 41
15. Proposed expenditures for agricultural research and extension in the Sixth Five-Year Plan (1980-85) 42
16. Budgeted and actual research expenditures, 1978/79-1980/81 average 43
17. Average total research expenditure and recurrent expenditure, by commodity, 1978/79-1980/81 44
18. Budgeted and actual research expenditure as a share of agricultural GDP and of expenditures on development, the agricultural sector, and agriculture, 1978/79-1980/81 average 45
19. Total trained agricultural personnel, 1979/80 46
20. Trained personnel in agricultural research, extension, and education, 1979/80 48
21. Trained personnel in agricultural research, by rank and research category, 1979/80 48
22. Trained officers in agricultural research, by education and discipline, 1979/80 48

23. Classification of 120 research officers by sex, education, and number of years and transfers in service 50
24. Researchers' opinions of promotion rules 51
25. Researchers' ratings of job-satisfaction criteria 51
26. Amount of researchers' time spent on research 52
27. Researchers engaged in nonresearch work 52
28. Researchers' opinions of allocation of work time 52
29. Researchers' reasons for accepting present positions 52
30. Researchers' preferences for different positions 53
31. Number of researchers' projects and publications, 1976-81 53
32. Initiators of researchers' current experiments 53
33. Researchers' ranking of constraints to research 54
34. Researchers' rating of research guidance from supervisor 54
35. Researchers' preferred organization of research bodies 54
36. Researchers' desire for further training 54
37. Share of various sectors in development expenditures during five-year plans, 1965-85 65
38. Total GDP, agricultural GDP, and budget expenditures, 1970/71-1980/81 65
39. High-yielding cereal varieties released in Nepal, 1959-85 66
40. Foreign-aided projects that partly support agricultural research activities in Nepal, 1982 67
41. Crop research budget expenditures, 1970/71-1980/81 68
42. Livestock development budget expenditures, 1970/71-1980/81 69
43. Horticultural farm budget expenditures, 1970/71-1980/81 70
44. Fisheries development budget expenditures, 1970/71-1980/81 71
45. Food and agricultural input research budget expenditures, 1970/71-1980/81 71
46. Socioeconomic and marketing research budget expenditures, 1975/76-1980/81 72
47. Classification of budget expenditures 72
48. Trained personnel in agriculture, by institution, 1983 73
49. Trained personnel in the Ministry of Agriculture and its parastatals, by discipline, 1983 73

ILLUSTRATIONS

1. Organization chart of the Department of Agriculture, 1972/73 28
2. Organization chart of the Department of Agriculture, 1982 30
3. Locations of agricultural research stations and farms 31

FOREWORD

If agriculture is to play a major role in economic development, the productivity of the factors of production used in agriculture (land, labor, and capital) must be increased. Because of the limited land base, the development of new technologies by means of agricultural research is essential to achieving these productivity increases. Ram Yadav's analysis of Nepal's agricultural research system shows dramatically that only a strong national research system can effectively adopt or adapt such technologies from the research of other countries.

In the period analyzed in this study, the government of Nepal and the foreign assistance community spent large sums on regional development programs and agricultural extension. In the developing world generally, and neighboring countries in particular, new agricultural technologies were developed and successfully applied, raising both aggregate growth rates in agriculture and aggregate yields of crops. But in Nepal, compared to much of the rest of the world, yield increases were slight and in many cases even negative. During this time, neither the government of Nepal nor the foreign assistance donors were attempting to develop a research system comparable to the systems developed decades earlier in other Asian countries.

The same inattention to agricultural research and the concomitant poor growth are apparent in the countries of Sub-Saharan Africa. Thus it is instructive to examine this Asian case in detail, not only for the direct lessons to Nepal, but also for the opportunities it offers for comparative analysis.

The interest of the International Food Policy Research Institute (IFPRI) in the issues raised by the case study of Nepal derives not only from our broad concerns with the role of agriculture in economic development (development strategy), but also from the point of view of optimal technology development policy. What is the relative emphasis needed on research—with what assumptions about how research resources can be made productive?

IFPRI has recently completed a case study of Nigeria as well as this one on Nepal. Comparative analyses of several African countries are in progress, and an integrative analysis will be prepared relating these analyses more broadly to technology policy.

For now, Ram Yadav's analysis suggests the need for a much higher level of budgetary support to agricultural research than has been the case in Nepal, a much larger training effort sustained for many years to provide the Ph.D. leadership essential to good research and to linking with other national and international systems, an effective overall coordinating and priority-setting council for agricultural research, and an incentive system that fosters stability of personnel and continuity of research. A large number of detailed recommendations also emerge from this analysis.

We are grateful to the International Development Research Centre (IDRC) for sponsoring Ram Yadav at IFPRI under an IDRC Professional Development Award that enabled the completion of this report; to Ram Yadav; and to the International Centre for Integrated Mountain Development (ICIMOD), where he is now deputy director, for his time to accomplish this valuable research at IFPRI.

John W. Mellor

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1

SUMMARY

Agriculture, which is the predominant sector of Nepal's economy, provides the major source of livelihood to 94 percent of the population and therefore must take the lead in Nepal's development. Accordingly, the agricultural sector received high priority for resource allocation in the three five-year plans between 1970 and 1985. Nevertheless, the achievements in agriculture have remained behind the targets in all development plans. Agricultural productivity has remained stagnant in most crops and has declined in maize and millet. From 1970/71 to 1980/81, gross foodgrain production increased at an annual rate of less than 1 percent, while the population increased at about 2.7 percent. This discrepancy resulted in a decline in the per capita net foodgrain production from 185 kilograms in 1970/71 to 160 kilograms in 1980/81. Production and productivity declined much faster in the hills and mountains than in the more fertile Tarai plain during this period.

The decomposition of agricultural growth trends carried out in this study indicates that increase of cropped area is the dominating factor in the growth of agricultural output. Overall, productivity decreased between 1961/62 and 1980/81, although it improved in the second half of that period, probably because of adoption of improved technology. In the same 20-year period, most cash crops showed greater production increases than did cereal crops. Although traditionally a food-exporting country, Nepal is on the verge of importing foodgrains to feed its rapidly growing population.

The objectives of this study include an assessment of national policy in Nepal toward improving agricultural technology, and an analysis of the institutional factors that affect agricultural production. The study is primarily based on secondary data and official documents that enabled an examination of the trends in agricultural production and productivity and of the resource allocation patterns from 1970/71 to 1980/81. In addition, 120 researchers at various levels were interviewed to learn their views regarding their status, authority, responsibility, performance, evaluation, salary, promotion rules, training needs, guidance and supervision, and research facilities.

In terms of financial resource allocation, the share of expenditure for the agricultural sector (which comprises agriculture, irrigation, forestry, land reform, and cadastral survey) increased over several five-year plans. However, the growth rate of the budget for the agriculture component alone was lower than that for other components of the agricultural sector. The real expenditure in agricultural research from 1970/71 to 1980/81 increased at about 4 percent annually, compared with 7 percent in agricultural extension and 14 percent in agricultural support services and other programs. The share of agricultural research expenditure as a percentage of agricultural GDP remained almost constant at around 0.22 percent during that period.

The low priority accorded to agricultural research is reflected in the substantial decline of agricultural research expenditure as a proportion of the agriculture budget (from 32 percent in 1970/71 to 14 percent in 1980/81). The proposed research expenditure for the Sixth Five-Year Plan (1980-85) showed a further decline to only 8 percent. Also, the money spent and manpower engaged in the disciplinary and commodity sections, research stations and farms, and commodity research programs were not all utilized for real research purposes. The three-year (1978/79-1980/81) average of the total research budget expenditure was about Rs 35.4 million, whereas the expenditure on actual research work was estimated to be only Rs 12.5 million, about 35 percent of the total. The remaining 65 percent was used for such nonresearch activities as producing and distributing improved seeds, plants, livestock, and fingerlings on farms; providing training to local farmers and extension workers; and providing technical assistance to farmers. On this basis, research investments represent only 0.1 percent of agricultural GDP in Nepal.

Of the total estimated actual research expenditure between 1970/71 and 1980/81, crop research constituted about 70 percent and 30 percent was directed to livestock (7 percent), horticulture (9 percent), and others (14 percent) consisting of fisheries, food, socioeconomic studies, and agricultural inputs. In crop research, cereal grains accounted for about 80 percent of research expenditure. Thus, research activities were largely limited to foodgrains, particularly rice, wheat, and maize. The 1970s also witnessed relatively greater research emphasis on hill agriculture. Factor-oriented research was almost negligible except in the use of chemical fertilizer. Input research accounted for 2 percent of the estimated actual research expenditure.

Presently, agricultural research is carried out by four departments in the Ministry of Agriculture and by other institutions outside the ministry. Even in the Department of Agriculture, the technical sections and commodity research programs are not unified. The unification of all agricultural research activities would allow a single body to effectively plan, organize, manage, control, and evaluate agricultural research activities throughout the country.

The eight commodity research programs (rice, wheat, maize, potato, citrus, sugarcane, pulses, and oilseeds) are concerned with solving a specific problem or developing a high-yielding variety without considering differences in the cropping patterns, resource endowments, or socioeconomic levels of farmers. Therefore, separate cropping system or farming system research is initiated to test the suitability of such agricultural technology in the existing farming system, but this is not a satisfactory solution. If researchers in the commodity research programs were fully cognizant of the farming systems, they could develop technologies to fit farmers' requirements. At present, an intermediary agency or unit called the Farming System Research Division tests these technologies under actual farm conditions and commonly reports to the commodity research programs that their technologies are inadequate to meet farmers' needs.

Researchers cite low salary, absence of job descriptions, low accountability, and poor training, guidance, supervision, and evaluation as causes of low motivation. Their productivity is affected by lack of proper research plans and programs, inadequate financial and administrative authority, lack of facilities for publication of research results, poor libraries, temporary appointments, and long delays in promotion. Improved management could provide the clear focus and direction that are needed to develop a strong and effective research system.

The project support approach of donors has not strengthened the overall agricultural research system in Nepal, though it has undoubtedly contributed to training researchers and building physical infrastructure in some components of agricultural research. This approach has distorted priorities and given rise to conflict between project and nonproject research staff because of differences in opportunities and privileges provided through the projects. To avoid these problems, a comprehensive plan of agricultural research is required. Donors invited to support such a plan could aid in strengthening and balancing the development of research. Currently, 32 foreign-aided projects supported by 13 different donors are in operation.

The research contact and collaboration of national research agencies with external research systems are extremely limited; such collaboration with neighboring countries is particularly low. Increased collaboration with the international research centers would be valuable. Since agricultural research is not given high priority and the capability of the system is low, there is little incentive to pursue collaboration. Nepal cannot afford to build and sustain a large, expensive agricultural research system and must rely greatly on technology from other national and international research systems. However, borrowing technology requires a certain minimum level of national research capability to carry out necessary adaptive research. Also, to collaborate effectively, Nepal's research capability needs to be expanded so that interaction with counterpart scientists in collaborating institutions becomes possible.

Another important consideration for strengthening agricultural research is the level of training required for agricultural researchers. The M.S. degree should be the minimum qualification for research scientists. Of the 400 researchers engaged in agricultural research in Nepal, more than half have only undergraduate training and only 14 have Ph.D. degrees. To meet the national training requirements of an M.S. degree in different fields of agriculture and animal science, the Institute of Agriculture and Animal Science at Rampur could be strengthened and developed into an agricultural university within the next 7 to 10 years. Doctoral training may have to be accomplished outside the country for quite some time. A research manpower development program is needed, with M.S. and Ph.D. training given high priority.

A high turnover of people at senior executive, planning, and policy levels indicates lack of continuity and commitment in implementing policies and plans. Simplification of budgetary procedures would be beneficial, as would delegation of financial and administrative authority to operational levels. Establishing a high national priority for research, unifying all agricultural research activities under an autonomous body, and improving the motivation of researchers through better personnel policies are the keys to a productive research system in Nepal.

2

INTRODUCTION

Nepal is a small Himalayan kingdom and one of the world's poorest nations, landlocked between China and India in an area of 147,482 square kilometers with a population of approximately 16 million. It is one of the least developed countries, with an estimated per capita GDP in 1982 of about U.S. $140.

The physical features of the country pose a serious constraint to its development. Nepal is divided into three physiographical belts: the Tarai (a plain that lies along the southern border between 75 and 300 meters above sea level), a wide band of hills (between 300 and 3,000 meters), and the northern mountains (from 3,000 to 8,500 meters). These three belts contain, respectively, 23, 42, and 35 percent of the total land area, and 44, 48, and 8 percent of the population. Approximately 16 percent of the total land area is under cultivation, 42 percent is under forest, 12 percent is permanent pastureland, 15 percent is under perpetual snow, and the remaining 15 percent is wasteland.[1] The Tarai, which accounts for about 54 percent of the country's total cultivated area, is the most fertile and is called the "granary of Nepal."

The considerable differences in climate within Nepal are due primarily to the variation in altitude. The Tarai is subtropical, the hills are temperate, and the mountains are alpine. These dramatic changes in climatic conditions occur over a north-south distance of only 240 kilometers.

Agriculture is the mainstay of the nation's economy, providing roughly 80 percent of employment and accounting for about two-thirds of total GDP and 80 percent of export earnings. If genuine economic development is to take place in Nepal, it will have to be led and supported by growth in agriculture, which will provide a base in the form of wage goods and capital for the development of other sectors.

In recent years, declining agricultural output has been the most crucial concern of policymakers and administrators. Accordingly, enhancing agricultural production, particularly food crop production, has been the central theme of a succession of annual agricultural development programs. All the agencies of the Ministry of Agriculture have been mobilized in direct support of the production effort, and three different types of programs are launched each year. The Intensive Program provides an integrated supply of inputs such as extension services, improved seeds, fertilizer, and credits to irrigated land in the Tarai. The Pocket Program furnishes a concentrated supply of inputs to potential pocket irrigation facilities in the hills[2] and the Tarai. The Normal Program offers encouragement in the use of improved seeds in partially irrigated areas or rainfed areas in the hills and the Tarai.

In addition to their regular work, senior officials from all government agriculture agencies, including the research division, are assigned responsibilities as district supervisors to supervise officials (program implementors) already working at the field level. These senior officials are required to identify problems faced during the execution of district agriculture programs and to provide solutions on the spot, if possible, or to present the problems at the national level. Thus, already inadequate research resources are diverted from the development of viable modern technology, which is essential for long-term development of agriculture, to augment the efforts of extension services and input supply management.

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[1] Nepal, Agricultural Projects Services Center, *Perspective Land Use Plan (1985-2005)* (Kathmandu: APROSC, 1986).

[2] Unless otherwise specified, further references to "the hills" or "hill agriculture" will include both the hill and mountain areas of Nepal.

The main thrust of these efforts has been on expanding extension services, conducting training programs, and making inputs and credit available to farmers. Although these aspects are unquestionably important, their effectiveness is greatly dependent upon improved agricultural technologies developed through a productive research system.

Agricultural research has been given insufficient importance and does not have clear objectives and well-defined strategies and programs. The functions of agricultural research stations and farms are ambiguous and change frequently. These research sites also suffer from insufficient equipment, financial resources, and trained personnel.[3]

A thorough reappraisal is needed of the role that research could be playing. Recognition of research as the crucial subsector is vital to solving Nepal's problems of underdevelopment. A comprehensive study to examine resource allocation in depth, to analyze the factors inhibiting development of a viable and productive research system, and to develop a strategy for a long-term agricultural research system aimed at sustained development of the agricultural sector is long overdue. This study is designed to meet that need.

First, the appropriateness of national policies regarding the generation and adoption of improved agricultural technology is reviewed, and the performance of the agricultural sector is examined with particular emphasis on the foodgrain subsector. Second, a review is made of the resource allocation patterns to and within the agricultural sector in general, and agricultural research in particular. Financial and personnel allocation patterns for agricultural research in the varied ecological regions are studied in detail: for example, the hills versus the Tarai; enterprises such as crops, livestock, and horticulture; and factor-oriented research topics such as soil, water, land use, conservation, and inputs. The components of the expenditure budget in terms of capital, staff salaries, and operational expenses for each subsector are also examined. Third, the institutional development of agricultural research is reviewed and the present organization and management of research vis-à-vis the research environment is examined. An analysis is made of research planning, implementation, monitoring, and incentives as they influence research productivity. Fourth, a broad-based strategy for a national research system is suggested. This strategy includes consideration of research priorities, organizational structures, staff development, and institutional linkages within a long-term development perspective for the agricultural sector.

The study is based primarily on secondary data and official documents concerning trends in agricultural production and productivity (yield)[4] and resource allocation patterns from 1970/71 to 1980/81. In addition, 120 researchers were interviewed about their working conditions and recommendations for improving motivation in the research system. A brief description of the agricultural sector is provided. Agricultural policies, strategies, and performance during various five-year plans are reviewed. Trends in agricultural output, cropped area, productivity, and inputs use from 1960/61 to 1980/81 are discussed. The history of agricultural research and the present organization, planning, monitoring, and evaluation processes are highlighted. Financial and manpower resource allocations are discussed, as are research incentives and management. Some concluding observations are made regarding agricultural research strategies, priorities, and structures.

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[3] Asian Development Bank/Nepal, *Nepal Agricultural Sector Strategy Study,* vol. 1 (Kathmandu: ADB and Nepal Government Press, 1982).

[4] These two terms (productivity and yield) are used interchangeably throughout the report to mean output per unit of land.

3

AGRICULTURAL PLAN, POLICY, AND PERFORMANCE—A REVIEW

The development of a productive and sustainable agricultural research system in Nepal requires a full understanding of the present agricultural system—its plan, policy, and performance. This chapter presents background information on landholdings, land distribution, farming practices, plan priorities, constraints, and policies. The performance of agriculture in foodgrain and cash crops from 1970/71 to 1980/81 is discussed, and factors contributing to increased production are analyzed.

Agricultural Background

Nepalese agriculture is largely characterized by a mixed farming system, heavily dependent upon monsoon rainfall. Only 14 percent of cultivated land is under irrigation. In 1981, the average size of holdings was estimated at 1.12 hectares per family of seven persons. The physiographical features of the country distinguish the hill agriculture from that of the Tarai. The per capita cultivated land is 0.12 hectare in the hills and 0.21 hectare in the Tarai. In the hills, the average farm size is only 0.85 hectare compared with 1.47 hectares in the Tarai. Terraced cultivation is practiced in the hills, where most of the cultivated land is in the upland category, largely devoid of irrigation, and with soil that is very low in plant nutrients. In the Tarai, where some of the cultivated land is under irrigation and most of it is potentially irrigable, flatland and lowland cultivation are practiced. The Tarai also has better physical and institutional infrastructures than are found in the hills.

Land distribution in Nepal is extremely skewed. Approximately 50 percent of households have holdings of less than one-half hectare, accounting for only 7 percent of the cultivated area. Conversely, 47 percent of cultivated land is covered by holdings of more than 3 hectares owned by only 9 percent of all households. Sixty-seven percent of households have holdings of less than 1 hectare, accounting for 17 percent of cultivated land.

The land distribution is even more skewed in the Tarai than in the hills. Among households owning less than one-half hectare of cultivated land, 46 percent of Tarai households own only 3 percent of all cultivated land in the Tarai, compared with 54 percent of hill households owning 12 percent of cultivated land in the hills. Among households owning more than 3 hectares of cultivated land, 14 percent of households in the Tarai own 58 percent of the Tarai land, compared with only 5 percent of households in the hills owning 34 percent of the hill land (see Table 1).

Crops

The principal foodgrain crops are paddy, maize, and wheat, which account for nearly 86 percent of the total cropped area and almost 93 percent of total cereal production. Paddy is cultivated on about 60 percent of the total cereal crop area. Maize, 60 percent of which is produced in the hills, occupies between 20 and 22 percent of the total cereal crop area. Although wheat is a relatively new crop in Nepal, it already accounts for between 16 and 18 percent of the total cereal crop area and is increasing.

Other minor cereal crops are millet, barley, and buckwheat. Trends over the last decade have shown no significant change in cultivated areas for these crops. The pulses are also important crops, both as part of the Nepalese diet and as key components of the cropping system in Nepal.

Jute, sugarcane, tobacco, oilseeds, and potato are the major nonfoodgrain crops and

Table 1—Farm size and distribution of cultivated landholdings, 1981

Region/Size of Holdings	Number of Households	Percentage of Total Households	Total Cultivated Hectares	Percentage of Total Cultivated Land	Average Cultivated Hectares per Holding
Nepal					
Less than 0.5 hectare	1,107,902	50.5	161,987	6.6	0.15
0.5–1.0 hectare	355,420	16.2	264,522	10.8	0.74
1.0–3.0 hectares	535,964	24.4	868,201	35.3	1.62
More than 3.0 hectares	194,623	8.9	1,160,628	47.3	5.96
Total	2,193,909	100.0	2,455,338	100.0	1.12
Tarai					
Less than 0.5 hectare	434,210	45.6	38,705	2.8	0.09
0.5–1.0 hectare	123,250	13.0	91,367	6.5	0.74
1.0–3.0 hectares	262,336	27.6	463,521	33.1	1.77
More than 3.0 hectares	131,312	13.8	807,833	57.6	6.15
Total	951,108	100.0	1,401,426	100.0	1.47
Hills and mountains					
Less than 0.5 hectare	673,692	54.2	123,2[illegible]	11.7	0.18
0.5–1.0 hectare	232,170	18.7	173,155	16.4	0.75
1.0–3.0 hectares	273,628	22.0	404,680	38.4	1.48
More than 3.0 hectares	63,311	5.1	352,795	33.5	5.57
Total	1,242,801	100.0	1,053,912	100.0	0.85

Source: Nepal, Central Bureau of Statistics, *Sample Census of Agriculture* (Kathmandu: CBS, 1981).

account for 10 to 12 percent of the total cropped area.

Livestock

Livestock are an integral part of the farming system in Nepal. Livestock production accounts for 21 percent of the total agricultural output and 15 percent of GDP. The most important animals are buffalo, cattle, goat, sheep, yaks, and pigs. Nepal has one of the highest ratios of grazing livestock per capita (5.8 animals per household) in the world. However, the productivity is extremely low because of low genetic potential, inadequate feeding, poor management, and widespread disease.

Horticulture

The wide climatic variation provides great scope for horticultural development in Nepal. Temperate-zone fruits can be successfully grown in the mountains and hills, citrus in the hills and the Tarai, and a range of tropical fruits in the Tarai. However, because of inadequate physical infrastructure and lack of an organized marketing network, this subsector is relatively undeveloped.

Fisheries

Because Nepal is a landlocked country, only inland fishery development is practiced. There are some river and pond fisheries. This subsector is gradually getting more attention in the country, though fish production constitutes a negligible part of the total agricultural output.

Agricultural Plans and Policies

In spite of a substantial investment in the agricultural sector (which comprises agriculture, forestry, irrigation, land reform, and cadastral survey) in the five-year plans between 1956 and 1980, agricultural productivity has remained relatively stagnant or, in some commodities, has declined.

Transport and communication received the highest priority during the first four plans (1956-75). It was only from the Fifth Plan that the agricultural sector received very high priority—with an allocation of 29.80 percent (actual expenditure was 25.43 percent) of the total plan outlay (see Appendix 1, Table 37). From 1970/71 to 1980/81, the agricultural sector expenditure increased from Rs 106.6 million to Rs 336.1 million (1972/73 rupees) at an annual rate of 14 percent. In the same period, total development expenditure increased at an annual rate of about 11 percent from Rs 523 million to Rs 1,356 million (see Appendix 1, Table 38). The agricultural sector was accorded the highest priority in the Sixth Five-Year Plan (1980-85) with an allocation of 30.34 percent of the total plan outlay to achieve a target annual growth rate of 3.2 percent (Appendix 1, Table 37).

Agricultural development strategy based on geographical comparative advantages was identified and initiated in the Fifth Plan. Accordingly, the plan emphasized foodgrain production in the Tarai, horticulture production in the hills, and livestock production in the mountains.

The Ten-Year Agriculture Plan (1975-85), prepared at the Investigation and Enquiry Centre of the Palace, had outlined four comprehensive objectives: to increase agricultural production and productivity on a sustained basis, both quantitatively and qualitatively, in view of rising population; to produce agricultural commodities needed to develop and sustain industry and trade and to support trade promotion and diversification; to pursue regional specialization in agricultural production based on geographical comparative advantages, needs, and priorities; and to improve the standard of living of farm families through agricultural development and creation of more employment opportunities for agricultural labor in the farm sector. Although the ten-year plan had carefully outlined the relevant objectives, strategies, and policies for agricultural development in Nepal, only the recommended organizational structure was effected; otherwise, the plan document remained mostly on the shelf.

Development Constraints

Past experience in agricultural development throughout various plans has emphasized the following constraints:

- Lack of suitable varieties of improved seeds for agricultural crops grown in different climatic regions of the country.
- Poor transport and communication along with rudimentary marketing networks; inadequate irrigation facilities, making agriculture largely dependent on the vagaries of the monsoon.
- Inadequate production support services such as improved seeds, fertilizers, insecticides, credit, and extension.
- Inadequate production incentives to farmers due to inequitable land tenure systems and an unfavorable price regime of agricultural inputs and output; insufficient motivation for researchers and extension workers to perform their work effectively.
- Lack of coordination and consistency in policy formulation, planning, and implementation for the use of land, water, and forests.
- Indiscriminate deforestation and lack of soil conservation measures leading to ecological imbalance and decline in soil fertility.

Recommended Policies

The following policies were recommended for agricultural development in the various plans:

- Generation of appropriate technologies suitable to different soil and climatic conditions; promotion of labor-intensive agricultural technology to create employment.
- Development of irrigation facilities to reduce dependency of agriculture on the vagaries of the monsoon and to raise agricultural production and productivity through intensification and multiple cropping.
- Program coordination of forestry, agriculture, and irrigation, with emphasis on scientific land use and improved conservation practices; integration and improvement in delivery of inputs, credits, and other services of various government agencies.
- Provision of incentives to increase production by instituting a favorable

price policy of agricultural inputs and outputs and implementing land reform programs to benefit the actual tillers of the land.

- Improvement in the income levels of small farmers, tenants, and landless agricultural laborers through special agricultural development projects such as the Small Farmer Development Project.
- Government directives to the commercial banks to lend a minimum of 7 percent of their total deposits to the agricultural and small-scale industry sectors.

Agricultural Performance

In the last two decades, agricultural productivity has declined in Nepal. During the same period, the cropped area has increased.

Trends in Agricultural Production and Productivity

From 1961/62 to 1980/81, total cereal grain production increased by an annual rate of only 1.10 percent, while productivity (yield) declined by 0.58 percent annually. The cropped area during this period increased by 1.69 percent annually. The annual rates of growth of foodgrain crops are presented in Table 2.

In the 1970s, total cereal grain production increased at an annual rate of 0.95 percent compared with 0.75 percent in the 1960s. Productivity declined at 0.46 percent annually in the 1970s compared with a decline of 1.0 percent in the 1960s. Similarly, the cropped area in the second period increased at 1.42 percent compared with 1.77 percent in the first period. Thus, both declines in productivity and increases in cropped area were smaller in the 1970s than in the 1960s.

Table 2—Annual growth rate of cereal crop area, production, and yield, 1961/62-1980/81

Cereal Crop/ Growth Segment	1961/62-1969/70		1970/71-1980/81[a]		1961/62-1980/81[a]	
	Percent	t-Statistic	Percent	t-Statistic	Percent	t-Statistic
Paddy						
Area	0.97	5.82	0.93	4.10	0.99	13.18
Production	0.45	1.02	0.73	1.03	0.90	4.16
Yield	−0.49	−1.25	−0.20	−0.39	−0.09	−0.51
Maize						
Area	−0.21	−0.56	0.24	1.81	0.24	2.24
Production	−1.36	−2.84	−1.06	−2.62	−0.66	−4.03
Yield	−1.15	−5.17	−1.30	−3.68	−0.90	−8.26
Wheat						
Area	10.31	4.49	5.82	10.16	8.34	15.33
Production	9.41	5.38	8.64	7.54	8.00	16.09
Yield	−0.84	−1.17	2.67	2.74	−0.33	−0.78
Barley						
Area	1.27	2.43	−0.71	−2.35	0.48	2.81
Production	−0.23	−0.22	−1.19	−1.83	−0.55	−1.83
Yield	−1.52	−2.08	−0.49	−1.26	−1.02	−4.30
Millet						
Area	7.61	6.01	0.54	1.78	3.48	7.05
Production	11.40	4.82	−0.44	−0.81	4.18	4.96
Yield	3.60	3.28	−0.97	−3.32	0.68	1.87
Total cereals						
Area	1.77	7.82	1.42	8.13	1.69	23.46
Production	0.75	2.21	0.95	2.10	1.10	7.60
Yield	−1.00	−2.82	−0.46	−1.39	−0.58	−4.74

Source: Unpublished data on area, production, and yield from the Department of Food and Agricultural Marketing Services, Nepal.

[a] 1979/80 is omitted because it was a drought year.

The productivity of wheat showed a positive growth rate of 2.67 percent in the 1970s. The productivity of maize, paddy, barley, and millet registered a negative growth rate. Maize, the second most important cereal grain, declined in both production and productivity at annual rates of 1.06 and 1.30 percent, respectively.

The per capita net (edible) foodgrain production declined from 185 kilograms in 1970/71 to 160 kilograms in 1980/81 (see Table 3). During this period, the real GDP grew at an annual rate of 1.53 percent, while the population increased at an annual rate of approximately 2.70 percent. Therefore, the real per capita income declined. The slow growth of GDP is essentially due to stagnation in agricultural production. The real agricultural GDP did not show any trend upward and remained almost stagnant for the whole period (Appendix 1, Table 38).

Production and yield in the hills and mountains declined much faster than in the Tarai from 1970/71 to 1980/81 (see Table 4). In the Tarai, total cereal grain production increased annually by 1.44 percent and yield remained almost unchanged. During the same period, production in the hills remained constant and yield declined annually at 1.14 percent. An increase in the cropped area for the Tarai, at the rate of 1.50 percent annually, kept production rising without any change in yield, while a decline in yield for the hills was offset by a 1.27 percent increase in the cropped area that left total production undiminished.

Wheat area, production, and yield increased faster in the Tarai than in the hills. The production of wheat in the Tarai increased substantially at 12.79 percent annually because of annual increases in yield of 3.96 percent and in cropped area of 8.50

Table 3—Per capita food production, 1970/71-1980/81

Year	Population	Food Production (Gross)	Food Production (Net)	Per Capita Net Foodgrain Production
	(millions)	(1,000 metric tons)		(kilograms)
1970/71	11.56	3,486	2,183	185
1971/72	11.87	3,492	2,170	183
1972/73	12.18	3,303	2,137	175
1973/74	12.50	3,706	2,330	186
1974/75	12.83	3,781	2,410	188
1975/76	13.17	3,908	2,436	185
1976/77	13.52	3,704	2,332	172
1977/78	13.88	3,585	2,262	163
1978/79	14.25	3,653	2,302	162
1979/80	14.63	3,196	2,000	137
1980/81	15.02	3,829	2,409	160

Source: Unpublished data on gross and net food production from the Department of Food and Agricultural Marketing Services, Nepal.

Notes: Population for various years is calculated on the basis of annual rate of growth of 2.66 percent. Conversion of gross food production into net (edible) food is made by the DFAMS as follows:

Losses in storage	10 percent
Losses in milling, for rice	40 percent
Losses in milling, for other grains	3 percent
Retention for seeds	
Paddy	55 kilograms per hectare
Maize	20 kilograms per hectare
Wheat	100 kilograms per hectare
Millet	20 kilograms per hectare
Barley	40 kilograms per hectare
Other losses	1 – 1.5 percent

Table 4—Annual growth rate of cereal crop area, production, and yield, by region, 1970/71-1980/81

Cereal Crop/ Growth Segment	Hills		Tarai		Total Nepal	
	Percent	t-Statistic	Percent	t-Statistic	Percent	t-Statistic
Paddy						
Area	1.98	8.93	0.71	2.96	0.93	4.10
Production	0.72	1.45	0.73	0.87	0.73	1.03
Yield	−1.24	−3.25	0.01	0.02	−0.20	−0.39
Maize						
Area	0.72	4.94	−0.86	−3.99	0.24	1.81
Production	−1.14	−2.30	−0.88	−1.11	−1.06	−2.62
Yield	−1.84	−4.70	−0.02	−0.02	−1.30	−3.68
Wheat						
Area	2.08	3.41	8.50	6.60	5.82	10.18
Production	3.86	6.05	12.79	5.17	8.64	7.54
Yield	1.74	3.51	3.96	2.13	2.67	2.74
Barley						
Area	0.24	1.00	−3.35	−1.89	−0.71	−2.35
Production	−1.61	−3.48	−0.20	−0.08	−1.19	−1.83
Yield	−1.85	−4.16	3.25	2.61	−0.49	−1.26
Millet						
Area	0.69	2.07	−0.24	−0.56	0.54	1.78
Production	−0.54	−0.86	0.16	0.31	−0.44	−0.81
Yield	−1.22	−3.54	0.41	2.41	−0.97	−3.32
Total cereals						
Area	1.27	8.77	1.50	5.90	1.42	8.13
Production	0.12	0.38	1.44	2.30	0.95	2.10
Yield	−1.14	−3.87	−0.06	−0.12	−0.46	−1.39

Source: Computed from unpublished data on area, production, and yield from the Department of Food and Agricultural Marketing Services, Nepal.
Note: 1979/80 is omitted because it was a drought year.

percent. Wheat production in the hills, however, increased at a rate of only 3.86 percent, with a productivity growth of 1.74 percent and cropped area growth at 2.08 percent.

The annual growth rates in area, production, and yield of cash crops are shown in Table 5. The area under cash crops increased at an annual rate of 2.23 percent from 1961/62 to 1980/81. From 1970/71 to 1980/81 the cash crop area increased by 1.12 percent compared with 3.19 percent from 1961/62 to 1969/70. Area and production of all cash crops, except tobacco, increased from 1961/62 to 1980/81. Sugarcane had the highest growth rate, 8.86 percent, while jute production increased only 2.46 percent. The yield of sugarcane and oilseeds increased, that of tobacco and potatoes declined, and jute yield remained almost constant. From 1970/71 to 1980/81, the area, production, and yield increased for sugarcane and oilseeds but declined for tobacco and potatoes. In the 1960s, area and production of all cash crops except oilseeds increased, while the yield of jute, tobacco, and potatoes declined. In general, the growth in yield of cash crops was better than for cereal crops, but was not highly encouraging.

Wheat and sugarcane showed an increase in production and productivity between 1961/62 and 1980/81. The data on the use of fertilizer for crops are not available on a yearly basis, so it is difficult to show empirically the effect of fertilizer use on the productivity increase of wheat and sugarcane. However, in 1981/82, chemical fertilizer was used on 17 percent of total area under wheat and 12 percent of total area under sugarcane, compared with only 3 and 8 percent of total area under maize

Table 5—Annual growth rate of cash crop area, production, and yield, 1961/62-1980/81

Cash Crop/ Growth Segment	1961/62-1969/70		1970/71-1980/81		1961/62-1980/81	
	Percent	t-Statistic	Percent	t-Statistic	Percent	t-Statistic
Sugarcane						
Area	11.72	5.10	6.12	6.18	7.43	12.50
Production	13.94	6.96	7.41	6.58	8.86	13.76
Yield	1.99	3.10	1.22	2.33	1.33	6.66
Jute						
Area	7.00	4.54	−1.18	−0.52	2.07	2.42
Production	3.60	4.77	1.38	0.75	2.46	4.54
Yield	−3.18	3.24	2.60	2.51	0.38	0.76
Oilseed						
Area	−1.67	2.83	2.06	2.61	1.10	3.20
Production	0.75	1.58	4.40	4.60	2.62	7.41
Yield	2.46	4.91	2.29	6.15	1.51	8.26
Tobacco						
Area	9.75	5.32	−1.51	−0.79	1.26	1.34
Production	3.20	0.88	−3.03	−1.70	−1.11	−1.17
Yield	−5.97	−2.82	−1.54	−2.88	−2.34	−4.14
Potato						
Area	12.42	6.96	−0.02	−0.05	4.74	2.77
Production	10.07	4.31	−0.74	−1.18	3.31	4.12
Yield	−2.09	−2.06	−0.73	−1.93	−1.37	−6.15
Total cash crops						
Area	3.19	12.48	1.12	1.60	2.23	9.41

Source: Computed from unpublished data on area, production, and yield from the Department of Food and Agricultural Marketing Services, Nepal.
Note: 1979/80 is omitted because it was a drought year.

and paddy, respectively.[5] Similarly, the national average use of fertilizer per hectare was 14 kilograms on wheat and 29 kilograms on sugarcane, compared with only 3 kilograms on maize and 4.5 kilograms on paddy. It is commonly observed that wheat and sugarcane are grown where some irrigation facilities are available, unlike paddy and maize, which are largely grown under rainfed conditions.

Decomposition of Growth Trends

Table 6 presents the annual growth rates (compound) of agricultural production and its components from 1961/62 to 1980/81. (See Appendix 2 for methodology.) This period was divided into two parts, 1961/62-1969/70 and 1970/71-1980/81, because of the possible effect of the "green revolution" in the 1970s. The growth rates of agricultural production and its components for the two periods, and for the combined period, clearly indicate that area effect is the dominating factor in the growth of agricultural production. The yield effect on production in these periods was negative.

From 1961/62 to 1969/70, negative yield effect was much greater than during 1970/71-1980/81. Moreover, the value in the second period was not significantly different from zero. Thus one may argue that the decline in production due to negative yield effect has been arrested, perhaps owing in part to improved technology. On the other hand, the cropping pattern effect was positive in the first period but negative in the second period. The positive sign of the cropping pattern implies a shift in favor of high-value crops. The first period showed

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[5] Nepal, National Planning Commission, Central Bureau of Statistics, *National Sample Census of Agriculture 1981/82* (Kathmandu: CBS, 1985).

Table 6—Annual growth rates (compound) of agricultural production and its components, 1961/62-1980/81

Period	Total Value of Production	Area Effect	Yield Effect	Cropping Pattern Effect	Interaction Between Yield and Cropping Effects
			(percent)		
1961/62-1969/70	1.522	1.901	−0.637	0.296	−0.038
1970/71-1980/81	1.125	1.441	−0.270[a]	−0.214	0.168
1961/62-1980/81	1.406	1.702	−0.304	−0.004[a]	0.012

Source: Unpublished data on area, production, and yield from the Department of Food and Agricultural Marketing Services, Nepal.

[a] Not significant at 95 percent level of confidence.

an increase in the proportion of cropped area under high-value crops such as sugarcane and tobacco. In the second period, there were substantial increases in the cropped area under wheat, which is a low-value crop compared with cash crops.

This analysis indicates that the application of improved technology has begun to influence the total production by arresting further decline in productivity. However, the direct positive contribution of technology to production has yet to occur. The exception is in the case of wheat, where there was a positive growth rate in productivity. The increase in production was mostly due to increases in cropped area, rather than increases in productivity, in contrast with the improvements in productivity that contributed to more than 70 percent of the food production growth in developing countries between 1961 and 1980.[6]

Trends in Use of Inputs

The use of fertilizer between 1970/71 and 1980/81 increased threefold, from 18,000 to 54,000 tons annually.[7] Despite this rapid increase, the overall rate of fertilizer application in 1980/81 was only 9 kilograms per cropped hectare, which is among the lowest in the world.[8] Also, the application of fertilizer was very uneven on a geographical basis. The most intensive fertilizer use occurred in the Kathmandu Valley (Kathmandu, Bhaktapur, and Lalitpur hill districts), accounting for more than one-third of total fertilizer use in the country. Less than one-fifth of total fertilizer use was in the remaining 52 hill and mountain districts (see Table 7). The average fertilizer use rate in Kathmandu Valley was about 72 kilograms per hectare per year, while in the Tarai and the hills (excluding the Kathmandu Valley), fertilizer rates were only about 9 kilograms and 4 kilograms of nutrients per hectare, respectively.[9]

The disbursement of institutional credit from the Agricultural Development Bank increased sevenfold from Rs 19 million to Rs 134 million between 1970/71 and 1980/81. Only 24 percent of the borrowing farm families borrowed from institutional sources in 1976/77; the rest had to depend upon private sources. Of the total amount borrowed, only 42 percent came from institutional sources.[10]

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[6] Leonardo A. Paulino, *Food in the Third World: Past Trends and Projections to 2000*, Research Report 52 (Washington, D.C.: International Food Policy Research Institute, 1986).

[7] All tons referred to in this report are metric tons.

[8] John M. Hill, *A Fertilizer Strategy for Nepal* (Muscle Shoals, Ala.: International Fertilizer Development Center, 1982), p. 25.

[9] Ibid., p. 27.

[10] Nepal Rastra Bank, *Agricultural Credit Review Survey* (Kathmandu: Nepal Rastra Bank, 1980).

Table 7—Annual consumption of chemical fertilizer, 1970/71-1980/81

Year	Hills	Kathmandu Valley	Tarai	Nepal
		(metric tons)		
1970/71	281	10,465	6,982	17,728
1971/72	1,145	12,368	11,921	25,434
1972/73	1,718	16,564	13,767	32,049
1973/74	2,051	15,474	19,252	36,777
1974/75	2,166	13,076	21,151	36,393
1975/76	3,340	12,039	15,750	31,129
1976/77	4,590	14,421	18,833	37,844
1977/78	6,726	15,753	22,754	45,233
1978/79	7,655	15,862	22,073	45,590
1979/80	9,593	16,503	24,191	50,287
1980/81	9,997	18,093	25,910	54,000

Source: Unpublished data from the Agriculture Inputs Corporation, Nepal.

The area under improved seeds of cereal crops, mainly wheat, paddy, and maize, increased substantially from 1970/71 to 1980/81. The area under improved wheat increased from 98,200 hectares in 1970/71 to about 380,000 hectares in 1980/81, achieving almost total saturation of wheat area under improved seed. Improved wheat varieties were introduced in Nepal only in 1960. The areas under improved paddy seed increased from 68,000 hectares in 1970/71 to 322,000 hectares in 1980/81, increasing the proportion of area under improved seed from 6 percent to 25 percent. Similarly, the area under improved maize increased from 12,000 hectares in 1970/71 to 157,000 hectares in 1980/81, raising the proportion of area under improved seed from 3 percent to 34 percent (see Table 8).

Annual data on irrigation are not collected systematically. The estimated total command area under irrigation in the country by 1980/81 was about 500,000 hectares, of which year-round irrigation facilities were available to only 115,000 hectares, which is only 4 percent of total cultivated land.[11]

District Agriculture Development offices have been opened in all 75 districts of Nepal to carry out extension services. The Training and Visit Extension System advocated by the World Bank has also been introduced in all 20 Tarai districts.

Research System Outputs

The agricultural research system released a total of 29 rice varieties between 1960 and 1985 (see Appendix 1, Table 39). Of these 29 varieties, 10 were intended for hills and 5 for rainfed conditions (Tarai only). Popular rice varieties among farmers were CH-45, Khumal-3, Taichung Native-1, Masuli, Sabitri, Janaki, Kanchan, Himali, and Bindeswari. Almost all varieties require irrigated land and high fertilization rates to perform well in the farmers' fields. An exception is Masuli, which can perform well even under medium to low levels of fertilization. No improved variety was available for upland rainfed rice cultivation during this period.[12]

Ten maize varieties were released between 1959 and 1985. Of these, three were for the Tarai, three for the hills, and four for both ecological areas. All varieties require medium to high fertilization levels and are recommended for both irrigated and rainfed conditions. Khumal yellow, Rampur composite, Arun-2, and Makalu-2 were the most popular varieties among farmers.

Fifteen wheat varieties have been released to date. Of these, 3 were for the hills, 11 for the Tarai, and 1 for both regions. All varieties are recommended for both irrigated and rainfed conditions and medium to high fertilizer use. Among these varieties, only Lerma-52, RR-21, and UP-262 were popular among farmers. Almost 80 percent of the improved wheat crop is RR-21. Lerma-52 was probably the next most popular variety but was used almost exclusively in the hills.

The progress in agricultural production does not seem commensurate with the

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[11] Asian Development Bank/Nepal, *Nepal Agricultural Sector Strategy Study*, vol. 2 (Kathmandu: ADB, 1982), p. 77.

[12] Nepal, Department of Agriculture, *The Integration of Research and Extension in Farmers' Fields: The Terminal Report of the Integrated Cereals Project* (Kathmandu: Ministry of Agriculture, 1985), pp. 49-51.

Table 8—Area under high-yielding varieties (HYVs) of wheat, paddy, and maize, 1970/71-1980/81

	Wheat			Paddy			Maize		
Year	Total Area	High-Yielding Varieties Area	Percentage of HYV Area	Total Area	High-Yielding Varieties Area	Percentage of HYV Area	Total Area	High-Yielding Varieties Area	Percentage of HYV Area
	(1,000 hectares)			(1,000 hectares)			(1,000 hectares)		
1970/71	228	98.2	43.1	1,182	67.8	5.7	446	11.6	2.6
1971/72	239	115.9	48.5	1,201	81.6	6.8	434	20.8	4.8
1972/73	259	170.3	65.7	1,139	177.3	15.5	437	35.1	8.0
1973/74	275	206.8	75.2	1,226	205.1	16.7	453	74.1	16.5
1974/75	291	246.9	84.8	1,240	222.6	18.0	458	79.0	17.2
1975/76	329	233.5	71.0	1,256	216.4	17.2	450	66.3	14.7
1976/77	348	254.2	73.0	1,262	220.3	17.4	445	83.0	18.6
1977/78	366	265.2	72.4	1,264	290.5	23.0	454	98.7	21.7
1978/79	374	311.3	83.2	1,263	326.8	25.8	432	108.8	25.2
1979/80	367	367.0	100.0	1,254	323.9	25.8	457	121.3	26.5
1980/81	391	380.0	97.0	1,276	322.2	25.2	457	157.1	34.4

Sources: Dana G. Dalrymple, *Development and Spread of High-Yielding Varieties of Wheat and Rice in the Less-Developed Nations*, Foreign Agricultural Report No. 95 (Washington, D.C.: U.S. Department of Agriculture, September 1978); and unpublished data from the Department of Agriculture, Nepal.

achievement in application of improved agricultural inputs. Although increases in the use of agricultural inputs are large in percentage terms, they are so small in absolute terms that their impact may not be measurable, particularly if the output measures themselves are relatively weak. Also, poor quality of improved seed, lack of irrigation, and inadequate use of fertilizer may be the reasons for the low yields.

Four hill districts (Kathmandu, Bhaktapur, Lalitpur, and Kabhre) and seven Tarai districts (Morang, Dhanusha, Bara, Parsa, Chitawan, Rupandehi, and Kapilbastu) contain about one-fourth of the total cropped area (2.4 million hectares) of the country. The Agriculture Inputs Corporation indicates that about 70 percent of the total fertilizer sale occurred in these 11 of the 75 districts in Nepal. Conversely, only 30 percent (about 15,000 tons of chemical fertilizer) was used on the three-fourths of total cropped area in the remaining 64 districts.[13] Thus the overall impact of fertilizer on agricultural productivity has not been noticeable at the national level. Even though there has been significant increase in the use of improved varieties, their performance in the field has not been satisfactory because of the absence or inadequate use of fertilizer and the lack of irrigation.

Frequent examples have been found of winter wheat grown as a second crop after paddy without large applications of fertilizer, resulting not only in very poor yields but also in substantially reduced yields of the paddy that followed. The decline in fertility arises from the compounding of two factors. One is loss of soil nutrients as the crop nutrient balance is upset by increased cropping intensity. The other is physical degradation, particularly in terms of moisture and air retention. A crop-nutrient balance study carried out at several cropping system sites indicates that less than half of all nutrients removed from the soil by crops in one year are being replaced by the application of organic and inorganic fertilizers.[14]

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[13] Nepal, Agriculture Inputs Corporation, *Basic Statistics of Agricultural Inputs in Nepal* (Kathmandu: AIC, 1983).

[14] S. B. Matherma, et al., "Notes on the Economics of the Use of Inorganic Fertilizer in Nepal," paper presented at the Eighth Summer Crops Workshop at Rampur, January 1981.

The five-year plans seem to have correctly identified the major constraints, outlined clear objectives, and recommended appropriate broad policy measures for the development of agriculture. However, the achievements have been disappointing, implying a lack of serious commitment to putting these policies into effect. The plans have mentioned institutional reform to motivate farmers to take advantage of improved agricultural technology, but no significant reforms seem to have been effected from 1960 to 1985 except, for a few years, the state monopoly of rice marketing, which was aimed primarily at increasing the revenue earnings rather than providing remunerative prices to the farmers. The difficulty of translating these policies into action has been compounded by adverse sociopolitical environments.

4

INSTITUTIONAL DEVELOPMENT OF AGRICULTURAL RESEARCH

Historically, agricultural research in Nepal has received low priority, since the presumption has always been that technology can be easily borrowed from outside. Researchers have been largely preoccupied with providing support services to development activities rather than concentrating on research work.

In the process of institutional development, the organization of agricultural research has evolved through three stages. First, there was a focus on a multidisciplinary approach, with research, extension, and training integrated under the Department of Agriculture. In the second stage, the Department of Agriculture was divided into five separate departments and agricultural research in the country became disintegrated and uncoordinated, since each department carried out its research and development work independently. The concept of multidisciplinary stations at the field level was abandoned during this period. The lack of coordination among the five departments emerged as a key factor for their amalgamation into one department in the third stage. Again, all agricultural research and extension activities were brought under one Department of Agriculture. All research units were made responsible for providing support services to extension, thus undermining their research capabilities. Changes in responsibilities among the deputy directors general of the department led to further disintegration of the research structure. The later creation of a separate Department of Livestock and Animal Health exacerbated this disintegration.

The Research Coordination Committee of the Ministry of Agriculture, which is at the apex of the system, has not been effective in fulfilling its planning and coordination role in agricultural research. Inadequate foreign assistance has contributed little to the development of a viable national agricultural research system, partly because of a project approach to funding. The weak research system has derived few of the benefits potentially available through greater and more active collaboration with other national and international agricultural research systems.

The beginning of agricultural research activities in Nepal can be traced back to 1924 with the opening of the Department of Agriculture and the establishment of a trial-demonstration farm in Singh Durbar, Kathmandu, and a fruit nursery farm at Godavary, Lalitpur. Agricultural farms were established later at Janakpur, Pokhara, and Parwanipur.

Starting in 1955, research sections, agricultural stations, and farms were established to test and modify technologies that were borrowed from neighboring and other foreign countries. In 1957 the Department of Agriculture, within the Ministry of Agriculture, consisted of a central directorate office with a director and two assistant directors and the following sections: Agronomy, Horticulture, Livestock and Dairy, Veterinary, Agricultural Engineering, Plant Pathology, Entomology, and Fisheries. The Department of Agriculture was responsible for overall development of agriculture in the country and carried out the three primary functions of research, training, and extension. The sections mentioned above were primarily responsible for research but also provided support services to extension programs through training and subject matter specialists.

The First Five-Year Plan (1956-60) put the primary focus on adaptive research for cereal crops—mainly paddy and maize—and finger millets.[15] Japanese varieties of paddy had shown considerable success in yields over local varieties. Similarly, Armillo de Cubano Flint—a variety of maize obtained from the United States—had demonstrated an increase in yield of 30 to 50 percent over local varieties on farmers' fields in the Tarai and submountain regions. Five new sections were opened in the Department of Agriculture during the First Plan: School of Agriculture, Agricultural Marketing and Farm Management (agricultural economics), Agricultural Extension, Soil, and Agricultural Botany.

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[15] Nepal, Ministry of Agriculture, *A General Outline of the First Five-Year Plan for Agriculture Development* (Kathmandu: MOA, 1957).

During this period, the formation of a Council of Agriculture was proposed. This group was to act as an advisory body to the Department of Agriculture in all matters of departmental activities, namely, research, extension, and teaching, but the council was never established.

In the 1960s, both the government and foreign donors believed that Nepal could benefit from technologies that brought the green revolution to many developing countries by dissemination of these technologies to farmers and provision of support services to accelerate their adoption. With land reform providing the farmers more incentives to produce, and with the establishment of village cooperative societies to supply the necessary inputs and credits, Nepal appeared to be ready for "takeoff" with an extension program that would have a real effect on production.[16]

In 1965/66 an intensive, coordinated agricultural development program was initiated with the assistance of the U.S. Agency for International Development (USAID) in 9 of Nepal's most productive districts—6 in the Tarai and 3 in Kathmandu Valley. This program was expanded to another 7 districts in the Tarai in the following year, and an intensive production program was established in 16 districts with improved practices accompanied by production inputs.

An integration of research and extension is reflected in the proposed regional program of the Department of Agriculture in 1966. The field activities of agricultural development were grouped into six regions. All the subject matter specialists on agricultural stations or farms in each region and all extension personnel were collectively responsible for agricultural development in those regions. Their job descriptions and responsibilities were clearly defined. This program emphasized extension activities more than research activities, perhaps because of a political thrust to show the effect on agricultural production of the land-reform program initiated in 1964 and the presumption that varieties and practices developed elsewhere could easily be transferred to farmers' fields.

As this regional program was about to be carried out in 1966, the Department of Agriculture was dissolved and five new departments were created in the Ministry of Agriculture: Agricultural Education and Research, Agricultural Extension, Horticulture, Livestock and Veterinary Science, and Fisheries.

The Agricultural Economics Section of the former Department of Agriculture was renamed the Economic Analysis and Planning Division (EAPD) and was brought directly under the Ministry of Agriculture. Its role was to conduct socioeconomic and marketing research. In addition, it was responsible for the overall planning and evaluation of agricultural programs in the Ministry of Agriculture.

Under the new organizational arrangements, the Department of Agricultural Education and Research consisted of seven sections, five agricultural stations, and five agricultural farms. The College of Agriculture was established under this department to conduct undergraduate training in agriculture and animal husbandry.

The Department of Agricultural Extension had two sections, namely, the Agricultural Information Section and the Rural Youth (4-H) Program Section. Extension activities throughout the country were organized and supervised by this department.

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[16] U.S. Agency for International Development, *Project History and Analysis Report—Agricultural Extension and Training* (367-11-110-054) (Washington, D.C.: USAID, 1965).

The Department of Livestock and Veterinary Science, responsible for animal research and development, consisted of 3 sections, 4 livestock development stations, 3 sheep development centers, 7 artificial insemination service centers, 4 poultry projects, and 33 veterinary hospitals. The Department of Horticulture had 18 horticultural farms and the Department of Fisheries had 7 fishery centers.

Before the reorganization of the Department of Agriculture, the agricultural stations were organized on a multidisciplinary basis. Field crops, horticulture, and livestock research were integrated at each station and the station manager was the coordinator of all activities. After the reorganization, the concept of the unified multidisciplinary station was abandoned. Each department wanted to have a portion of each station under its control. This led to fragmentation of the stations, without overall coordination, since each station section was directly responsible to its respective department. This fragmentation also duplicated logistical tasks, since each section had its own administrative unit, and complicated and lengthened the coordination process.

In the formulation and implementation of programs, there was a serious lack of coordination among departments within the same ministry. Because of these coordination problems and sluggish growth in agricultural production, three top-level agricultural technicians were asked by Janch Bujha Kendra (the Investigation and Enquiry Centre of the Palace) to prepare a 10-year agriculture plan and to suggest an effective organizational setup. The 10-year agricultural development program was approved by the government, and the organizational setup, as outlined in the plan, was established in 1972/73. The five departments that had been created in 1966 were amalgamated into one Department of Agriculture. The organizational structure of the department is shown in Figure 1.

The new element in the proposed structure of the department was regionalization (to match the regional corridor development concept of the government).[17] Regional agricultural directorates were opened in four development regions of the country (Eastern, Central, Western, and Far Western)[18] to carry out agricultural development activities, with the main focus on extension services.

The crop-coordinated research program that had been initiated in 1971, under the Department of Agricultural Education and Research, received due recognition. Coordinated crop development programs were launched for paddy, wheat, maize, citrus, and potatoes, emphasizing agricultural improvement through problem-oriented, multidisciplinary research teams concentrating their attention on a major commodity or problem area.

Horticulture was divided into two separate sections, Fruit Development and Vegetable Development. Similarly, livestock was divided into Animal Development Section 1 and Animal Development Section 2. Section 1 was responsible for the development of large animals such as buffalo, cattle, and yaks, and for feed fodder and pasture. Section 2 was responsible for the development of small animals and birds such as sheep, goats, pigs, and poultry.

Thus agricultural research was organized into sections, partly on a commodity basis and partly along discipline lines. Each section was entrusted with the responsibilities of both research and development. This led to gradual dilution of research efforts in favor of extension activities. Research units were placed in two categories, based on their coverage of either national (central) or regional agricultural research and development programs.

The sections and agricultural stations that engaged in research to support the national agricultural development activities fell into

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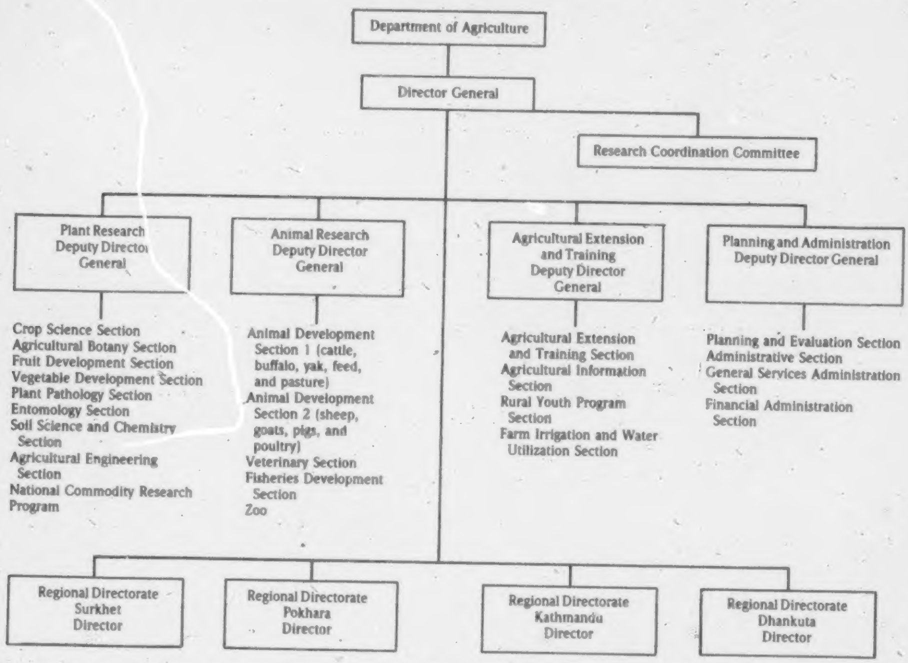
[17] In the Fourth Five-Year Plan (1970-75), considering national development in spatial dimension, growth axes were proposed along major north-south roads. This led to creation of four development regions in 1972. For detailed discussion on regional development strategy see Nepal, National Planning Commission, *The Fourth Plan, 1970-75* (Kathmandu: NPC, 1970), Appendix 3, pp. 328-340.

[18] In 1980 the Far Western Region was split into two regions (Midwestern and Far Western), creating the present total of five regional agricultural directorates.

Figure 1—Organization chart of the Department of Agriculture, 1972/73


Department of Agriculture
Director General
Research Coordination Committee
Plant Research Deputy Director General
Animal Research Deputy Director General
Agricultural Extension and Training Deputy Director General
Planning and Administration Deputy Director General
Crop Science Section
Agricultural Botany Section
Fruit Development Section
Vegetable Development Section
Plant Pathology Section
Entomology Section
Soil Science and Chemistry Section
Agricultural Engineering Section
National Commodity Research Program
Animal Development Section 1 (cattle, buffalo, yak, feed, and pasture)
Animal Development Section 2 (sheep, goats, pigs, and poultry)
Veterinary Section
Fisheries Development Section
Zoo
Agricultural Extension and Training Section
Agricultural Information Section
Rural Youth Program Section
Farm Irrigation and Water Utilization Section
Planning and Evaluation Section
Administrative Section
General Services Administration Section
Financial Administration Section
Regional Directorate Surkhet Director
Regional Directorate Pokhara Director
Regional Directorate Kathmandu Director
Regional Directorate Dhankuta Director

Source: Nepal, Ministry of Agriculture, *Ten-Year Agriculture Plan* (Kathmandu: MOA, 1972).

the first category, the Central Research Program. All the plant and animal science research sections, national coordinated crop development programs, and agricultural research stations were administered by the Central Directorate of Agriculture in Kathmandu.

Research farms specific to a commodity or discipline belonged to the second category, Agricultural Research Farms, under the Regional Agricultural Directorate. These farms engaged in three activities: providing technical backstopping to the extension program; conducting field experiments pertinent to the Central Research Program; and producing improved seeds, fruit plants, and animals.

Under reorganization, a new Department of Food and Agricultural Marketing Services was opened, and the Department of Irrigation, Hydrology, and Meteorology of the Ministry of Water and Power was brought under the Ministry of Food and Agriculture, which was renamed the Ministry of Food, Agriculture, and Irrigation. Three divisions, Planning and Coordination, Evaluation and Project Analysis, and Administration and Fiscal Management, and a Project Review Committee were established in the ministry.

A National Agricultural Development Committee, under the chairmanship of the minister of food, agriculture, and irrigation, was also set up to formulate agricultural policies and provide guidelines for agricultural development. Similarly, an Agricultural Research Coordination Committee was created under the chairmanship of the director general of the Department of Agriculture to provide guidelines for research policy and priorities. These committees remained dormant.

In 1979 a separate Department of Livestock Development and Animal Health was again created from the Department of Agriculture. This new department opened a Regional Directorate of Livestock Development and Animal Health in each development region of the country.

The internal organization of the Department of Agriculture was further changed in 1982, and research sections were brought under three deputy directors general (see Figure 2). The Agricultural Botany and Agronomy sections, eight agricultural stations, and the national commodity programs for six crops are now under the deputy director general of crop production, whereas the Soil Science and Agricultural Chemistry, Plant Pathology, Entomology, and Agricultural Engineering sections are under the deputy director general of technical services and extension. The development sections for fisheries, fruits, and vegetables and the national commodity programs for potatoes and citrus are under the deputy director general of horticulture and fisheries. Another interesting feature of the reorganization is that the Agricultural Information Section, which is closely related to extension, is not under the deputy director general of technical services and extension, but under the deputy director general of planning and evaluation. Also, some agricultural farms are under a regional agricultural directorate, although other regional directorates currently have no farms. The production support bias and the balance of work distribution among the deputy directors general seem to be the guiding factors in the current reorganization. Thus these compartmentalizations have further disintegrated agricultural research activities.

Present Agricultural Research Structure

The Ministry of Agriculture presently consists of the Department of Agriculture, the Department of Livestock Development and Animal Health, the Department of Food and Agricultural Marketing Services, and the Central Food Research Laboratory.

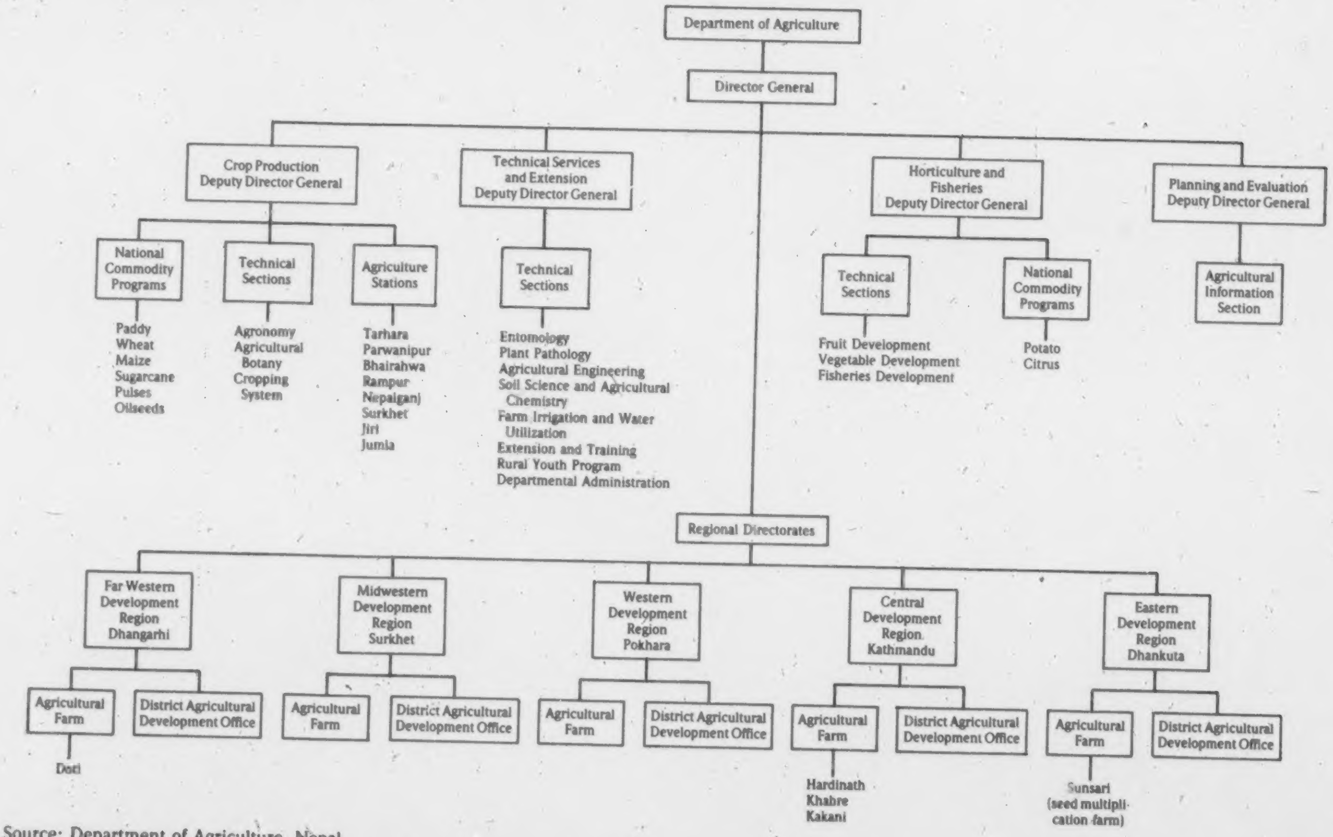
Department of Agriculture

Agricultural research within the Department of Agriculture is organized into disciplinary and commodity sections in addition to national commodity research programs. Agricultural research stations and agricultural farms have been established in various parts of the country for the purpose of research and production support programs (see Figure 3).

There are eight disciplinary sections: Agronomy, Agricultural Botany, Entomology, Plant Pathology, Soil Science and Agricultural Chemistry, Agricultural Engineering, Socioeconomic Research and Extension, and Farming Systems Research. These sections are located at Khumaltar, Kathmandu Valley. Along with the three commodity sections discussed below, they are the technical arms of the Department of Agriculture. The main functions of the disciplinary sections are to conduct and coordinate research activities in their respective disciplines at the research section, the head offices of commodity research programs, agricultural stations, and agricultural farms. The Agronomy Section carries out varietal and fertilizer trials and varietal improvement through plant breeding, and also does cropping system research. The Agricultural Botany Section does seed testing, inspection, and certification. The Plant Pathology Section conducts research on plant diseases and mushrooms. The Soil Science Section conducts soil tests and biogas research. The work of the Entomology Section includes sericulture and apiculture, besides research on insect pests of plants. The Socioeconomic Research and Extension Section conducts research on adoption of recommended technology, and the Farming Systems Research Section focuses on the suitability of technology, taking the total farming system into account.

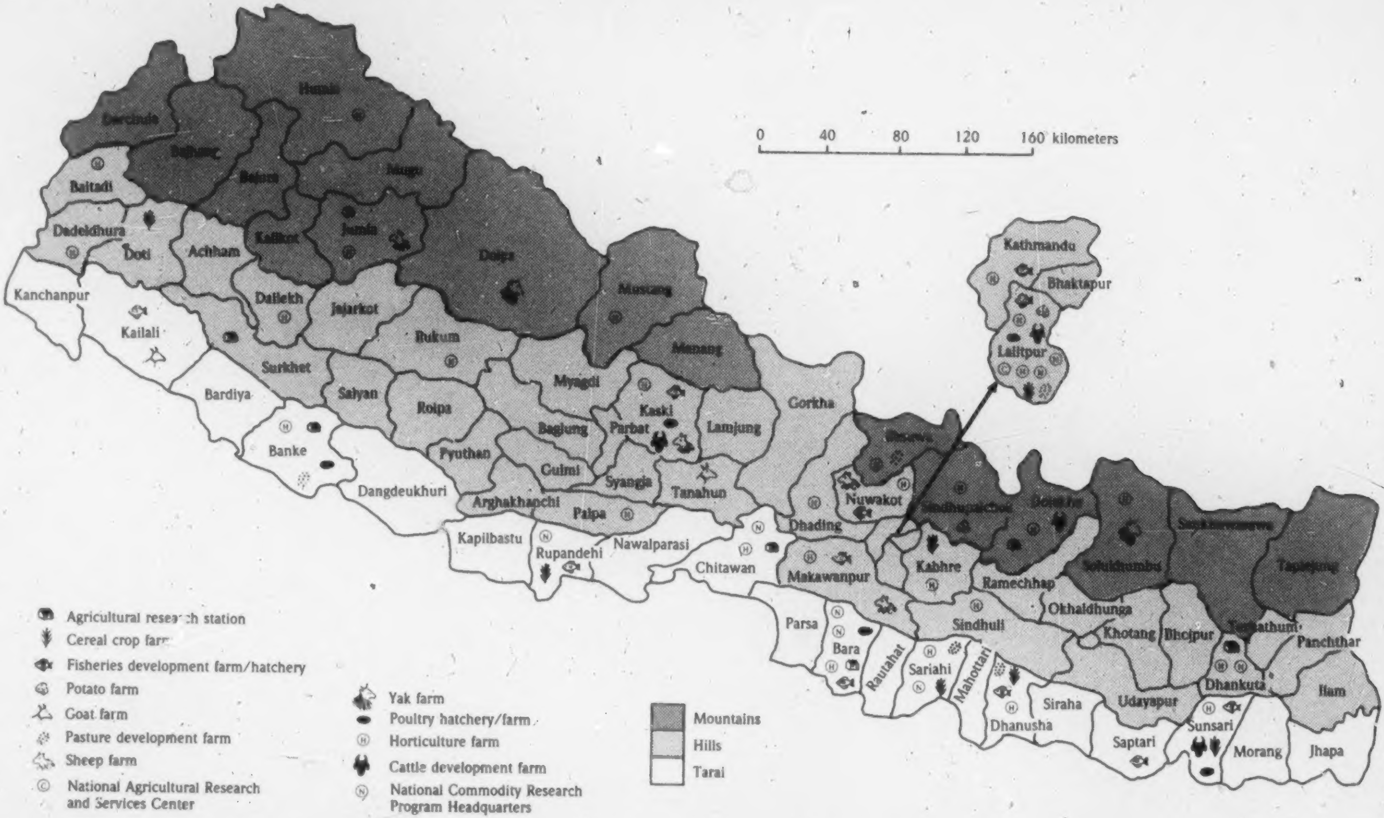
The three commodity sections are Fruit Development, Vegetable Development, and Fisheries Development. The fruit and vegetable sections are responsible for conducting and coordinating research and developmental activities in horticulture. These sections concentrate primarily on production and production-support activities. For fruits, some

Figure 2—Organization chart of the Department of Agriculture, 1982


Department of Agriculture
Director General
Crop Production Deputy Director General
Technical Services and Extension Deputy Director General
Horticulture and Fisheries Deputy Director General
Planning and Evaluation Deputy Director General
National Commodity Programs
Paddy
Wheat
Maize
Sugarcane
Pulses
Oilseeds
Technical Sections
Agronomy
Agricultural Botany
Cropping System
Agriculture Stations
Tarhara
Parwanipur
Bhairahwa
Rampur
Nepalganj
Surkhet
Jiri
Jumla
Technical Sections
Entomology
Plant Pathology
Agricultural Engineering
Soil Science and Agricultural Chemistry
Farm Irrigation and Water Utilization
Extension and Training
Rural Youth Program
Departmental Administration
Technical Sections
Fruit Development
Vegetable Development
Fisheries Development
National Commodity Programs
Potato
Citrus
Agricultural Information Section
Regional Directorates
Far Western Development Region Dhangarhi
Midwestern Development Region Surkhet
Western Development Region Pokhara
Central Development Region Kathmandu
Eastern Development Region Dhankuta
Agricultural Farm
District Agricultural Development Office
Doti
Agricultural Farm
District Agricultural Development Office
Agricultural Farm
District Agricultural Development Office
Agricultural Farm
District Agricultural Development Office
Hardinath
Khabre
Kakani
Agricultural Farm
District Agricultural Development Office
Sunsari (seed multiplication farm)

Source: Department of Agriculture, Nepal.

Figure 3—Locations of agricultural research stations and farms


0
40
80
120
160 kilometers
Humla
Darchula
Bajhang
Bajura
Mugu
Baitadi
Dadeldhura
Doti
Achham
Kalikot
Jumla
Dolpa
Mustang
Manang
Kanchanpur
Kailali
Dailekh
Jajarkot
Rukum
Surkhet
Bardiya
Salyan
Rolpa
Myagdi
Kaski
Parbat
Lamjung
Gorkha
Banke
Pyuthan
Baglung
Gulmi
Syangja
Tanahun
Dangdeukhuri
Arghakhanchi
Palpa
Kapilbastu
Rupandehi
Nawalparasi
Chitawan
Dhading
Nuwakot
Rasuwa
Sindhupalchok
Dolakha
Solukhumbu
Sankhuwasabha
Taplejung
Kathmandu
Bhaktapur
Lalitpur
Makawanpur
Kabhre
Ramechhap
Okhaldhunga
Khotang
Bhojpur
Terhathum
Panchthar
Ilam
Dhankuta
Parsa
Bara
Rautahat
Sariahi
Sindhuli
Mahottari
Dhanusha
Siraha
Udayapur
Saptari
Sunsari
Morang
Jhapa
Agricultural research station
Cereal crop farm
Fisheries development farm/hatchery
Potato farm
Goat farm
Pasture development farm
Sheep farm
National Agricultural Research and Services Center
Yak farm
Poultry hatchery/farm
Horticulture farm
Cattle development farm
National Commodity Research Program Headquarters
Mountains
Hills
Tarai

Sources: Survey Department, Topographical Survey Branch, Nepal, 1982 (for map); and Ministry of Agriculture, Nepal, 1986 (for information about the farms).

research is carried out on varietal selection and propagation methods along with plant protection measures. For vegetables, quality seed production is the major activity; some varietal trials and plant protection trials are also conducted. In all, there are 26 horticultural farms and 4 horticultural units within the multipurpose agricultural stations at various locations in the hills and the Tarai. Only a few of them are truly engaged in research; they are Marpha, Jumla, Nawalpur, Yogyapuri, Nepalganj, Pokhara, Khumaltar, Kirtipur, and Dhankuta.

The Fisheries Development Section does research and developmental work for fisheries. Of the 11 fisheries development centers in the country, 6 are involved in some research work, but their main functions are to produce fingerlings and distribute them to farmers. The research activities of the centers include induced breeding techniques, incubation of fish eggs, limnological surveys of natural bodies of water, polyculture, integrated fish farming, and cage culture.

Eight national commodity research programs have been established to coordinate all research and production activities in a multidisciplinary approach. The program commodities and headquarters are shown below.

Crop	Headquarters
Paddy	Parwanipur
Wheat	Bhairahwa
Maize	Rampur
Potato	Khumaltar
Citrus	Khumaltar
Sugarcane	Jitpur
Pulses	Khumaltar
Oilseed	Nawalpur

Of these eight commodity research programs, the sugarcane, pulses, and oilseed programs are recent additions. Only the paddy, wheat, and maize programs are reasonably well established, with the financial and technical assistance of USAID, under the Integrated Cereals Project. The potato program has received some financial and technical assistance from the government of Switzerland. The responsibility for tobacco and cotton research had been with the Ministry of Industry but was recently transferred to the Department of Agriculture. Jute research is still with the Ministry of Industry.

Eight agricultural stations have been established in different agroclimatic areas for research and development activities. They are located in Tarhara, Dhankuta (headquarters of the citrus development program), Parwanipur, Rampur, Jiri, Nepalganj, Jumla, and Surkhet. These stations are centers of multipurpose activities and provide support services to extension through training and technical backstopping in addition to research. They essentially provide links between various national commodity research programs, central disciplinary sections, extension agencies, and farmers. The headquarters of some of the commodity programs are located at these stations, which also serve as testing sites for the programs and for disciplinary sections. Additionally, they are used for on-the-job training of extension workers and farmers.

Agricultural farms are established to concentrate on a single commodity or activity. For example, there are agricultural farms that deal only with cereal crops; horticultural farms deal only with fruits and vegetables. For cereal crops, 7 farms are engaged in adaptive research, seed multiplication, and other production support activities. They are Hardinath, Nawalpur, Bhairahwa, Khavre, Doti, Jhumka, and Khumaltar.

The cropping system program was initiated in 1977 after the recognition that each commodity research program and disciplinary section was concerned with solving a specific problem or developing a high-yielding variety without considering the work in the context of differences in cropping patterns, resource endowments, or socioeconomic levels of farmers. Also, the farming system in Nepal is a mixed-enterprise system, so the purpose of cropping system research is to test improved technologies under the conditions encountered by small farmers, and then to recommend appropriate technologies based on the farmers' cropping patterns. The cropping system research activities are conducted on farmers' fields at six different sites in Nepal.

For the hills, the research sites are Lele (Lalitpur), Pumdi Bhumdi (Kaski), Chaurjahari (Rukum), Khadbari (Sankhuwasawa), and in the Tarai, Sukhchaina (Parsa), and Tandi (Chitawan).[19] The program also carries out socioeconomic surveys to analyze factors affecting the adoption of improved technology and to identify the constraints of such adoptions. This program has developed methodologies of on-farm research that are useful to commodity programs and cropping systems, and to extension in carrying out production programs. The cropping system program will gradually expand to conduct a study for a total farming system, including livestock and other economic activities of farmers.

With the goal of improving the organization of research units, the Seventh Five-Year Plan (1985-90) made provision for the National Agricultural Research and Services Center (NARSC), which came into existence on December 31, 1985. NARSC's basic objective is to bring the different research activities of the Department of Agriculture together under one agency to provide coordination in research. The research units under NARSC are disciplinary and commodity sections, national commodity research programs, and agricultural stations and farms located in various parts of the country.

The functions of NARSC are to prepare short- and long-term research programs for submission to the National Agricultural Research Coordination Committee (NARCC); to execute, monitor, and supervise the programs approved by NARCC; to publish technical papers of research results; to prepare manpower and physical resource inventories for the operating and development plans of the research units; to set up a well-organized library; and to establish an Office of Biometrics to guide research centers and their staff in sound biometrical procedures for research. Since NARSC is in the Department of Agriculture, its coordination of research programs is restricted to field crops, horticultural crops, and fisheries.

Department of Livestock Development and Animal Health

The Department of Livestock Development and Animal Health has two main centers headed by two deputy directors general. The Livestock Development Center has five sections: Animal Nutrition, Animal Breeding, Animal Pasture and Fodder, Poultry, and Animal Production and Management. The Animal Health Center also has five sections: Biological Products for Production of Vaccines, Disease Investigation and Research Laboratory, Rabies Control, Foot-and-Mouth Disease, and Central Veterinary Hospital. Nepal has four cattle development farms, two yak farms, three sheep farms, two goat farms, five brooder hatcheries, and four pasture crop development farms. Research activities in livestock are limited. Livestock farms are largely concerned with the production of superior livestock breeds and their distribution. The only unit that carries out some veterinary research is the Disease Investigation and Research Laboratory. Livestock farms conduct very limited research in animal nutrition and breeding.

Department of Food and Agricultural Marketing Services

Economic and marketing analysis in agriculture is conducted by the Department of Food and Agricultural Marketing Services (DFAMS). DFAMS has three divisions: Economic Analysis, Agricultural Marketing Services, and Agricultural Statistics. Only the Economic Analysis Division is engaged in some socioeconomic research.

Central Food Research Laboratory

The Central Food Research Laboratory is a separate agency with the status of a department in the Ministry of Agriculture. Its major activities are related to regulating such functions as food testing and quality control by fixing certain minimum quality and purity standards for different food products. The agency also conducts some research on fruit and vegetable processing in Kathmandu and analyzes the nutritional value of different foods and food products.

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[19] The names in parentheses are the districts in which the research sites are located.

Other Research Institutes

Other institutes engaged in agricultural research are the Institute of Agriculture and Animal Sciences (IAAS) at Rampur, under Tribhuvan University, and the Agricultural Projects Services Center (APROSC) in Kathmandu. IAAS conducts both physical and social science research, whereas APROSC is mainly concerned with research related to project formulation, evaluation, and agricultural policy.

The fragmentation of agricultural research is further illustrated in the conduct of irrigation management research by the Department of Irrigation, Hydrology, and Meteorology in the Ministry of Water Resources; soil conservation and erosion control research by the Department of Soil Conservation and Watershed Management; and silviculture research by the Department of Forestry in the Ministry of Forestry and Soil Conservation (MFSC). The Department of Medicinal Plants is the largest unit under MFSC to be involved in research. It has four sections: Royal Drug Research Laboratory, Royal Botanical Garden, Botanical Survey and Herbarium, and Herbal Farms.

Research Planning

Each technical (disciplinary or commodity) section and national commodity research program is required to prepare its annual program along with its annual budget for presentation to the National Planning Commission and the Ministry of Finance. The inputs from crop workshops that are held twice yearly (in January for summer crops and in August for winter crops) are used in preparing the annual programs. The research achievements and planned activities of the commodity research program and those of the technical section that are related to the commodity program are discussed in the workshops. The comments and suggestions of the workshops are solicited to modify certain activities in the proposed programs. The workshops are attended by the joint secretaries of the Ministry of Agriculture, the director general and deputy directors general of the Department of Agriculture, regional directors, the chiefs of technical sections and commodity programs, and a group of district agricultural development officers. Representatives of the Agriculture Inputs Corporation, the Agricultural Development Bank, the Department of Food and Agricultural Marketing Services, IAAS, and APROSC are also invited.

The annual research programs thus prepared by technical sections and commodity programs are submitted to the Department of Agriculture. These research programs are subsequently submitted to and discussed in the Ministry of Agriculture and are then passed to the National Planning Commission and the Ministry of Finance for further discussion and budget approval.

The planning procedure using inputs from the workshops is largely restricted to main cereal and cash crops. Since the research programs for fruits, vegetables, livestock, and fisheries are limited, they are not subjected to this rigorous planning procedure.

The current target-oriented programming and evaluation has led to an undervaluation of the importance of research in agricultural stations and farms. For example, each farm is required to fix targets for production of seeds, animals, or fingerlings and for the number of persons to be trained or training courses to be conducted every year. Similarly, a target is set for the number of research experiments to be conducted. These targets are broken down on a quarterly basis and farms are expected to report in their quarterly evaluation the number of research experiments carried out and other targets achieved. Thus a farm with multiple functions can achieve 70 to 80 percent of its targets, showing a good performance without doing research. This problem is due not only to the low priority accorded to research but also to a faulty evaluation system based on physical targets.

Research Coordination

The Agricultural Research Coordination Committee, constituted in 1972/73 under the chairmanship of the director general of the Department of Agriculture, was reestablished in 1980/81 under the chairmanship of the secretary of agriculture but remained inactive. The other committee members named were the joint secretary of the Evaluation and Project Analysis Division of the Ministry of Agriculture; the joint secretary (agriculture) of the National Planning Commission; the director general of the Department of Livestock Development and Animal Health; the deputy director general (crop research) of the Department of Agriculture; the deputy director general of the Department of Food and Agricultural Marketing Services; the chief of the Central Food Research Laboratory; subject matter specialists in the fields of crop science, agricultural botany, horticulture, plant protection, livestock and veterinary science, fisheries, agricultural engineering, and farm irrigation; and two farmers' representatives.

The designated functions of the research committee were to determine agricultural research priorities and policies; to approve research projects submitted by research agencies after ascertaining that the projects are consistent with research priorities and policies; to provide the necessary financial and personnel resources to carry out the projects effectively; to conduct regular monitoring and evaluations of research projects; and to initiate contacts and develop relations with other national and international agencies in the field of agricultural research. No separate secretariat was ever established for this committee.

The need for an effective and functioning research coordination committee at the national level to streamline the agricultural research system was again recognized in the Seventh Five-Year Plan (1985-90). Therefore, the existing Agricultural Research Coordination Committee has been reconstituted and renamed the National Agricultural Research Coordination Committee (NARCC) under the chairmanship of the secretary of the Ministry of Agriculture. The other committee members are the joint secretaries of the Planning and Coordination Division of the Ministry of Agriculture, the National Planning Commission (agriculture), the Ministry of Finance, and the Ministry of General Administration; the directors general of the Department of Agriculture, the Department of Livestock and Animal Health, and the Department of Food and Agricultural Marketing Services; representatives from the Royal Nepal Academy of Science and Technology and the Institute of Agriculture and Animal Science of Tribhuvan University; the chiefs of the Central Food Research Laboratory and the National Agricultural Research and Services Center; two farmers' representatives; and three representatives from a group of eminent scientists.

A permanent secretariat of the committee has been established in the Ministry of Agriculture. There is now a provision for a full-time member secretary (joint-secretary level) who also acts as the chief executive officer and has a panel of technical personnel and supporting staff.

Donor Assistance and Research Collaboration

Apart from greater national effort, two other important factors can help build the national research system: external assistance and collaboration with other national and international research systems.

Project Versus Program Assistance

Generally, external agencies support agricultural research on the basis of a project, rather than a program, approach. This causes both distortions in the resource allocations and conflict among project staff and nonproject staff due to differences in opportunities and privileges throughout a project. For instance, under the Integrated Cereals Project, USAID support was limited to three major foodgrain crops, namely, paddy, wheat, and maize, and was not extended to livestock and horticulture. Dr. Vernon W. Ruttan, whose work in the field of agricultural research systems is well known, contends that "the project support approach to agricultural development assistance has rarely been effective in contributing to the development of viable national agricultural development institutions."[20] There are currently 32 foreign-aided projects supported by 13 different external agencies to help in agricultural research, resource assessment, and data acquisition in Nepal (see Appendix I, Table 40).

USAID has been the major donor agency to support agricultural research in Nepal. From 1957 to 1984, USAID contributed about U.S. $23 million to assist in establishing research and extension systems, with the main emphasis on foodgrain crops, through technical assistance, equipment and material, and training. The *Report of the IFAD Special Programming Mission to Nepal* emphasizes development of fruit and livestock to effect a shift toward an appropriate balance among commodities.[21] To bring about a balanced development of the total agricultural research system, a long-term comprehensive plan for agricultural research in terms of its structure, physical facilities, and staff development needs to be prepared. Similarly, the commitment of funds on a long-term basis to implement such a plan needs to be sought.

Collaboration with External Research Systems

Nepal's collaboration with other national and international agricultural research systems is extremely limited. One reason for this limitation is the weak Nepalese research system. Unless the level of research and scientific staff improves, it will be difficult, if not impossible, to establish and maintain contacts with other systems and to realize mutual benefit for collaborators. Nepal could benefit greatly from collaboration with the Indian agricultural research system, which is relatively well developed in the region, but only the Nepalese wheat, rice, and sugarcane programs have established contacts with the respective programs in India. Even these contacts were initiated entirely on a personal basis among the scientists. Useful collaboration could also be established with India in many other areas of crops, livestock, and horticulture. Other collaborators include the Asian Regional Maize Program in Thailand and at the University of Hawaii, and the International Winter Wheat Nursery Program at the University of Nebraska in the United States.

As for contacts with the international agricultural research centers, Nepal has some collaboration with the International Rice Research Institute (IRRI) and the International Center for Maize and Wheat Improvement (CIMMYT), but only limited collaboration with the International Potato Center (CIP), the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), the International Center for Agricultural Research in the Dry Areas (ICARDA), and the International Food Policy Research Institute (IFPRI). Exchanges of germplasm and visits of scientists between Nepal and these international centers have taken place. Some Nepalese research scientists have also received short-term training at IRRI and CIMMYT.

Comparison with Neighboring Research Systems

Compared with the agricultural research systems of India, Pakistan, and Bangladesh, which are organized under autonomous councils, the Nepalese system has three important distinguishing features. First, the Nepalese agricultural research system operates under government departments within the rules and regulations of the civil service. Second, Nepal's research units or activities are not unified under one body, but operate separately within different departments of the government and have serious problems of coordination. Third, the research sections, commodity research programs, and agricultural stations and farms are entrusted with responsibilities of both research and development (production support) activities.

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[20] Vernon W. Ruttan, "Reforming the Global Agricultural Research Support System," *Bulletin 83-2,* Economic Development Center, University of Minnesota, March 1983.

[21] International Fund for Agricultural Development, *Report of the Special Programming Mission to Nepal* (Rome: IFAD, 1979).

Need for Social Scientists

An important factor missing in the present research system is the involvement of social scientists with biological scientists in agricultural technology development. There is no social scientist working with any disciplinary or commodity section, commodity research program, or farming research unit anywhere in the country. A single Nepalese agricultural economist who had worked with a farming system research unit returned recently from IRRI after completing his Ph.D. In the development of improved technology, omission of the socioeconomic aspect is a serious constraint in recommending technology consistent with farmers' problems and resource endowments. The need for social scientists to work closely with physical and biological scientists has recently been recognized.

5

ALLOCATION OF FINANCIAL AND PERSONNEL RESOURCES FOR RESEARCH

The agricultural sector includes agriculture, irrigation, forestry, land reform, and cadastral survey. From 1970/71 to 1980/81, the rate of annual increase in expenditure on the agriculture component was only 11 percent in real terms, compared to 15 percent on irrigation and 19 percent on forestry. During the same period, the agriculture expenditure constituted about 42 percent of the total agricultural sector budget (calculated from Table 9). The average shares of expenditure on agriculture as a percentage of agricultural GDP and of development expenditure were 1.2 and 10.2 percent, respectively.

Real expenditure in agricultural research increased annually at about 4 percent, from Rs 14.5 million in 1970/71 to Rs 18 million in 1980/81 (see Table 10). Similarly, real expenditure in agricultural extension increased annually about 7 percent from Rs 6.3 million in 1970/71 to Rs 10.9 million in 1980/81.

Table 11 presents the average shares and annual growth rates of expenditure on research, by discipline, between 1970/71 and 1980/81. Crops, livestock, and horticulture together constituted 81 percent of the total expenditure. Though the expenditure on socioeconomic research constituted the lowest share, its annual growth rate has been the highest (12.5 percent) because of a low base value. On the other hand, crop research constituted the highest share (37 percent), but its growth rate was the lowest (less than 3 percent). The real expenditure on input research, which comprised expenditures in the agricultural engineering section, soil science, and agricultural chemistry, declined during this period. The annual

Table 9—Agricultural sector budget expenditures, 1970/71-1980/81

Year	Irrigation	Forestry	Land Reform and Cadastral Survey	Agriculture	Total Agricultural Sector
			(1972/73 Rs million)		
1970/71	42.2	10.0	8.8	45.53	106.6
1971/72	49.8	14.7	9.2	45.07	118.7
1972/73	34.3	13.2	11.0	61.81	120.3
1973/74	68.4	14.3	10.6	75.03	168.3
1974/75	55.2	18.0	15.3	66.12	154.6
1975/76	69.5	26.2	16.3	146.92	259.0
1976/77	90.0	31.7	22.3	128.55	272.5
1977/78	91.9	48.9	22.1	121.55	283.7
1978/79	140.5	41.5	28.3	122.00	332.3
1979/80	131.0	53.0	20.8	86.44	291.3
1980/81	143.1	44.3	21.1	127.59	336.1
			(percent)		
Annual growth rate	14.89	18.89	11.85	10.95	13.56
t-statistic	8.06	9.77	6.68	3.87	9.13

Source: Nepal, Ministry of Finance, *Budget Speeches,* various fiscal years (Kathmandu: MOF, various years).
Note: Irrigation, forestry, land reform and cadastral survey, and agriculture are the components of the agricultural sector.

Table 10—Budget expenditures on agricultural research and extension and other agricultural items, 1970/71-1980/81

Year	Agricultural Research	Agricultural Extension	Other Agricultural Expenditures[a]	Total Agriculture
		(1972/73 Rs million)		
1970/71	14.468	6.308	24.75	45.53
1971/72	14.456	8.626	21.99	45.07
1972/73	14.280	8.503	39.03	61.81
1973/74	15.966	8.534	50.53	75.03
1974/75	16.031	7.661	42.43	66.12
1975/76	18.693	11.196	117.03	146.92
1976/77	20.162	13.745	94.64	128.55
1977/78	20.024	13.325	88.20	121.55
1978/79	21.814	15.087	85.10	122.00
1979/80	19.351	13.188	53.90	86.44
1980/81	18.079	10.859	98.65	127.59
		(percent)		
Annual growth rate	3.92	7.16	14.35	10.95
t-statistic	4.61	4.18	3.70	3.97

Source: Nepal, Auditor General's Office, *Auditor General Annual Report,* various issues (Kathmandu: AGO, various years).

[a] Includes expenditures on administration and subsidies on seed, fertilizer, credit, and food distribution.

Table 11—Agricultural research expenditures, by discipline, 1970/71-1980/81

Year	Crop Research	Livestock Research	Horticultural Research	Fisheries Research	Input Research	Food Research	Socioeconomic and Marketing Research
				(1972/73 Rs million)			
1970/71	5.624	4.269	1.627	1.232	0.898	0.556	0.260
1971/72	6.476	3.129	1.989	0.974	0.992	0.533	0.362
1972/73	5.791	3.222	2.598	0.900	0.676	0.914	0.179
1973/74	5.181	3.747	3.345	1.049	1.052	1.182	0.409
1974/75	5.141	3.647	4.127	1.049	0.778	0.663	0.626
1975/76	6.214	3.670	4.649	2.188	0.615	0.812	0.544
1976/77	7.536	3.883	4.739	1.858	0.758	0.733	0.654
1977/78	7.206	4.108	4.884	1.424	0.820	0.805	0.777
1978/79	8.858	4.217	4.713	1.590	0.851	0.894	0.691
1979/80	6.318	5.541	3.878	1.361	0.774	0.791	0.688
1980/81	6.678	4.532	3.555	1.288	0.538	0.783	0.704
Annual average	6.457	3.993	3.642	1.355	0.796	0.788	0.536
				(percent)			
Average share	37.00	23.00	21.00	8.00	4.50	4.50	3.00
Growth rate	2.84	3.34	8.78	4.13	−3.03	2.35	12.47
t-statistic	2.06	2.84	3.35	1.67	−1.83	1.08	4.26

Source: Calculated from Nepal, Auditor General's Office, *Auditor General Annual Report,* various issues (Kathmandu: AGO, various years).

Note: The detailed components of these classifications are presented in Appendix 1, Tables 41 through 46.

growth rate of real expenditure for horticulture was 9 percent; livestock, 3 percent; fisheries, 4 percent; and food, 2 percent.

Between 1970/71 and 1980/81, the expenditure on agricultural research in the hills increased from Rs 5.6 million to Rs 7.4 million at 6 percent annually, while the expenditure in the Tarai (where fisheries research is concentrated) increased from about Rs 5.7 million to Rs 6.6 million, at an annual rate of 3 percent (see Table 12). Expenditures for crop, horticulture, and livestock research in the hills increased at 8, 9, and 4 percent a year, respectively (see Table 13). Thus it is evident that during the 1970s, hill agricultural research was accorded a high priority.

Real expenditures on the single-discipline research programs of the technical sections increased by only 2 percent annually during the same period, from Rs 3 million to Rs 4 million.

Annual budget expenditures of technical sections, agricultural stations, and farms fluctuated widely during this period, and in most cases their expenditures in real terms were constant or declined, particularly after 1975/76 (see Appendix 1, Tables 41-46).

Table 12—Agricultural research expenditures on hill, Tarai, and disciplinary research, 1970/71-1980/81

Year	Tarai	Hill	Disciplinary	Total
	(1972/73 Rs million)			
1970/71	5.734	5.569	3.163	14.466
1971/72	6.127	4.917	3.412	14.456
1972/73	6.219	4.997	3.064	14.280
1973/74	5.817	6.086	4.063	15.966
1974/75	5.712	6.376	3.943	16.031
1975/76	7.382	7.788	3.523	18.693
1976/77	8.277	7.801	4.084	20.162
1977/78	7.988	8.028	4.008	20.024
1978/79	9.000	8.523	4.291	21.814
1979/80	6.816	8.823	3.712	19.351
1980/81	6.642	7.440	4.000	18.078
	(percent)			
Growth rate	3.02	5.74	2.33	3.93
t-statistic	2.38	5.43	2.79	4.61

Source: Calculated from Nepal, Auditor General's Office, *Auditor General Annual Report*, various issues (Kathmandu: AGO, various years).

Agricultural research expenditure as a share of agricultural GDP has remained around 0.22 percent between 1970/71 and 1980/81 (see Table 14). However, agricultural research expenditure as a share of total development expenditure declined from 2.76 percent in 1970/71 to 1.33 percent in 1980/81. Similarly, agricultural research as a share of the agricultural sector and agriculture budget expenditures declined substantially from 13.60 and 31.77 percent, respectively, in 1970/71 to 5.40 and 14.17 percent in 1980/81. The proposed research expenditure as a share of the agriculture component for the Sixth Five-Year Plan (1980-85) shows a further decline to only 8.0 percent (see Table 15).

The money and personnel used in the technical sections, research stations, commodity research programs, and agricultural farms are categorized as research expenditures in government budget documents, although the real research expenditure is less (see Table 16). For analysis purposes, the budgeted research expenditure and the actual research expenditure are separated. What the government considers research expenditure, which is generally reported, has been termed "budgeted" research expenditure, while expenditure on activities that would qualify as actual research work has been termed "actual" research expenditure. The actual research expenditure was estimated as the expenditure that is made exclusively for research purposes from total budget expenditure in the technical sections, commodity research programs, agricultural stations, and farms. A three-year average (1978/79-1980/81) of the total budgeted research expenditure was about Rs 35.4 million, of which crop research constituted 38 percent; livestock, 24; horticulture, 20; fisheries, 7; food, 4; socioeconomic, 4; and input, 3 percent. The average budgeted recurrent research expenditure was about 26.6 million, which was 75 percent of the budgeted research expenditure for the three years. The estimated

Table 13—Agricultural research expenditures, by region and discipline, 1970/71-1980/81

Year	Tarai				Hill			
	Crops	Horticulture	Livestock	Fisheries	Crops	Horticulture	Livestock	Fisheries
	(1972/73 Rs million)							
1970/71	3.592	0.444	1.016	0.682	0.583	1.183	3.253	0.550
1971/72	4.222	0.450	0.849	0.606	0.730	1.539	2.280	0.368
1972/73	4.102	0.449	0.984	0.684	0.394	2.149	2.238	0.216
1973/74	3.411	0.518	1.094	0.793	0.586	2.827	2.418	0.256
1974/75	2.986	0.892	1.092	0.742	0.628	3.234	2.207	0.307
1975/76	4.134	1.300	0.893	1.055	0.887	3.349	2.420	1.133
1976/77	5.030	0.994	1.093	1.160	1.209	3.745	2.148	0.698
1977/78	5.062	0.950	0.962	1.014	1.069	3.934	2.614	0.411
1978/79	5.929	1.102	0.811	1.159	1.497	3.611	2.983	0.431
1979/80	4.240	0.798	0.544	1.234	0.999	3.080	4.616	0.127
1980/81	4.256	0.797	0.680	0.908	0.796	2.762	3.501	0.380
	(percent)							
Growth rate	3.03	8.75	−4.12	6.37	8.20	8.90	3.87	−2.04
t-statistics	1.79	2.99	−2.45	4.27	2.79	3.25	1.84	−0.35

Source: Calculated from Nepal, Auditor General's Office, *Auditor General Annual Report*, various issues (Kathmandu: AGO, various years).

Table 14—Agricultural research expenditure as a share of agricultural GDP and of expenditures on development, agricultural sector, and agriculture, 1970/71-1980/81

Year	Agricultural Research Expenditure Shares			
	Agricultural GDP	Total Development Expenditure	Agricultural Sector Expenditure	Agriculture Expenditure
	(percent)			
1970/71	0.19	2.76	13.6	31.77
1971/72	0.16	2.31	12.2	32.07
1972/73	0.19	2.35	11.9	23.10
1973/74	0.18	2.43	9.5	21.28
1974/75	0.19	2.22	10.4	24.25
1975/76	0.23	2.13	7.2	12.72
1976/77	0.28	1.90	7.3	15.68
1977/78	0.27	1.73	7.1	16.47
1978/79	0.26	1.78	6.6	17.88
1979/80	0.25	1.49	6.6	22.39
1980/81	0.23	1.33	5.4	14.17

Sources: Nepal, Auditor General's Office, *Auditor General Annual Report*, various issues (Kathmandu: AGO, various years); and Nepal, Ministry of Finance, *Budget Speeches*, various fiscal years (Kathmandu: MOF, various years).

Note: The agricultural sector comprises agriculture, irrigation, forestry, land reform, and cadastral survey.

Table 15—Proposed expenditures for agricultural research and extension in the Sixth Five-Year Plan (1980-85)

Category	Research	Extension	Total Research and Extension
		(Rs million)	
Foodgrains	102.0	428.9	530.9
Cash crops	16.3	10.8	27.1
Horticulture	35.6	24.3	59.9
Special programs	. . .	100.0	100.0
Livestock	21.7	443.5	465.2
Fisheries	8.1	37.0	45.1
Total	183.7	1,044.5	1,228.2

Source: Nepal, National Planning Commission, *The Sixth Five-Year Plan* (1980-85) (Kathmandu: NPC, 1981).
Note: Total proposed agriculture expenditure was Rs 2,300 million.

actual research expenditure was only Rs 12.5 million, which was about 35 percent of the budgeted research expenditure. Similarly, the actual recurrent research expenditure was only Rs 8.5 million, or about 32 percent of the budgeted recurrent research expenditure. Of the estimated actual research expenditure, crop research constituted 69 percent and other categories amounted to less than 10 percent each.

The estimated actual research expenditure for individual crops is shown in Table 17. The research on cereal grain crops accounted for about 80 percent of all research expenditure on farm crops. The share of three main cereal grains—paddy, wheat, and maize—is 80 percent of the total value of all farm crops and 82 percent of the total cropped area. This implies perfect congruity in research allocation for cereal grains. The congruity index computed for all farm crops is 0.90, which is high, indicating a fair allocation of research resources among commodities. However, when the research allocation is examined for each commodity with respect to its contribution to agricultural GDP, the research expenditure for paddy appears to be comparatively low. Paddy alone constituted about 50 percent of the total value of all crops and 51 percent of the total cropped area, but accounted for only 23 percent of total research expenditure and only 19 percent of operating expenses. Research expenditure per million rupees of paddy production is the lowest for any crop, at only Rs 383. The recurrent research expenditure per million rupees of paddy production is even lower, at Rs 194.

Wheat research has received more favorable support, since it accounted for only 13 percent of the total value of crops but received 23 percent of the crop research resources.

Among cash crops, tobacco received the highest research allocation, accounting for only 1 percent of the total value of crops but receiving 6 percent of the crop research resources. The research expenditure per million rupees of tobacco production was Rs 4,883. Low budgetary allocation to sugarcane research was aptly described by the sugarcane coordinator:

> The sugarcane program is virtually a one-man program at present. Some posts are lying vacant due to study leave, deputation to other places, or transfer of the concerned personnel. Other posts are serving now as shunting stations for personnel with temporary appointments. Frequent changes of staff make no fruitful contribution to the program. Under such circumstances, quality research work cannot be done, nor is it possible to undertake essential research tasks. An annual budget of Rs 300,000-600,000, mostly covering salary, is absolutely inadequate for running the research projects of utmost need.[22]

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[22] Arun Kumar Rai, *National Report on Sugarcane—1982/83* (Kathmandu: National Sugarcane Development Programme, Department of Agriculture, 1983).

Table 16—Budgeted and actual research expenditures, 1978/79-1980/81 average

Category	Budgeted Research Expenditure	Percentage of Budgeted Research Expenditure	Budgeted Recurrent Research Expenditure[a]	Percentage of Budgeted Recurrent Research Expenditure[a]	Actual Research Expenditure	Percentage of Actual Research Expenditure	Actual Recurrent Research Expenditure[a]	Percentage of Actual Recurrent Research Expenditure[a]
	(Rs 1,000)		(Rs 1,000)		(Rs 1,000)		(Rs 1,000)	
Crops	13,047	38	8,821	33	8,639	69	5,187	61
Livestock	8,587	24	5,826	22	859	7	583	7
Horticulture	7,216	20	6,382	24	1,082	9	957	11
Fisheries	2,525	7	1,935	7	202	2	155	2
Food	1,474	4	1,317	5	590	5	527	6
Socioeconomic	1,252	4	1,227	5	789	6	773	9
Input	1,276	3	1,062	4	306	2	255	3
Total	35,377	100	26,570	100	12,467	100	8,437	100

Sources: Calculated from Nepal, Auditor General's Office, *Auditor General Annual Report*, various issues (Kathmandu: AGO, various years); and Nepal, National Planning Commission, *Agriculture Plans and Programs for 1982/83* (Kathmandu: NPC, 1982).

Note: The 1982/83 plan provides the annual budget and the work plan for each unit and program, along with the weightage of different activities to be carried out under them. The proportion of the research expenditure in each sector is calculated as a weighted average: livestock, 10 percent; horticulture, 15 percent; fisheries, 8 percent; food, 40 percent; socioeconomic, 63 percent; and input research, 24 percent. The actual research expenditure for crops was estimated differently (see Appendix 1, Table 41).

[a] Recurrent expenditures are labor and operating expenses.

Table 17—Average total research expenditure and recurrent expenditure, by commodity, 1978/79-1980/81

Commodity	Actual Research Expenditure	Percentage of Actual Research Expenditure	Research Expenditure per Million Rupees of Value of Production	Share of Each Crop in Total Value of All Crops	Share of Each Crop in Total Area of All Crops	Recurrent Research Expenditure[a]	Percentage of Recurrent Research Expenditure[a]	Recurrent Research Expenditure per Million Rupees of Value of Production[a]
	(Rs 1,000)		(Rs)	(percent)		(Rs 1,000)		(Rs)
Paddy	1,958	23.0	383	49.5	50.1	990	19	194
Wheat	1,946	23.0	1,477	12.8	15.0	1,030	20	782
Maize	2,809[b]	33.0[b]	1,289[b]	18.1	17.3	1,628[b]	31[b]	745[b]
Millet				3.0	4.9			
Barley	...	...	...	0.6	1.1	...	...	...
Potato	397	4.0	583	6.6	2.1	306	6	450
Sugarcane	348	4.0	3,071	1.1	0.9	289	6	2,551
Oilseed	409	5.0	803	4.9	5.8	262	5	521
Jute	...	...	...	1.7	1.8	...	...	...
Tobacco	521	6.0	4,883	1.0	0.3	505	10	4,733
Tea	...	...	...	0.1	0.1	...	...	...
Ginger	46	0.5	912	0.5	...	46	1	912
Cardamom	206	2.0	9,075	0.2	...	131	2	5,771
Total	8,640	100.0[c]	837[d]	100.0[c]	100.0[c]	5,187	100	502[d]

Sources: Computed from Nepal, Auditor General's Office, *Auditor General Annual Report,* various issues (Kathmandu: AGO, various years); and unpublished data on area and production from the Department of Food and Agricultural Marketing Services, Nepal.

Notes: Research expenditure is the average of three years: 1978/79, 1979/80, and 1980/81. Total value of all crops is the average of two years: 1978/79 and 1980/81. The year 1979/80 is omitted because it was a famine year.

[a] Recurrent expenditures are labor and operating expenses.

[b] Combined figure for maize and millet.

[c] Parts do not add to total because of rounding.

[d] Expenditure per million rupees of all crops.

The research expenditure per million rupees of all crops was Rs 837, while the recurrent research expenditure per million rupees of all crops was Rs 502.

The total budgeted agricultural research expenditure was about 0.25 percent of the agricultural GDP (see Table 18). However, the actual research expenditure was only about 0.10 percent of the agricultural GDP. Thus the budgeted research expenditure is highly overestimated compared to the actual expenditure.

An IFPRI/ISNAR study indicates that the average level of agricultural research investment in relation to agricultural GDP for 51 developing countries was 0.56 percent for 1980.[23] A desirable investment target for research in countries with poorly developed agricultural research systems would be an annual expenditure equivalent to about 2 percent of agricultural domestic product.[24] Nepal compares poorly with other developing countries in this regard.

The total budgeted research expenditures were 6.61 percent of the agricultural sector expenditure and 17.48 percent of the agriculture component expenditure, whereas the actual research expenditures were only 2.39 and 6.80 percent, respectively (Table 18).

Capital, Staff Salaries, and Operating Expenses

The components of the research budget expenditure in terms of capital, staff salaries and allowances, and other operating expenses are analyzed in this study. On average, from 1970/71 to 1980/81, capital expenditure constituted 29.6 percent, staff salaries were 36.6 percent, and other operating expenses amounted to 33.80 percent of agricultural research expenditure. However, the share of capital expenditure declined from 45.9 percent in 1970/71 to 21.6 percent in 1980/81, while the shares of staff salaries and other operating expenses increased from 25.2 and 28.9 percent to 42.7 and 35.7 percent, respectively.

A declining trend in capital expenditure and an increase in recurrent expenditure implies that some basic minimum physical infrastructure has been built over the years. Almost 75 percent of the research cost was recurrent expenditure. Of the recurrent costs, on average, salary constituted 55 percent in crops, 34 percent in livestock, and 63 percent in horticulture. In the case of livestock, most of the recurrent expenditure was incurred for the purchase of feed and veterinary medicines for livestock.

Table 18—Budgeted and actual research expenditure as a share of agricultural GDP and of expenditures on development, the agricultural sector, and agriculture, 1978/79-1980/81 average

	Research Expenditure Shares			
Category	Agricultural GDP	Development Expenditure	Agricultural Sector Expenditure[a]	Agriculture Expenditure
			(percent)	
Total budgeted research expenditure	0.25	1.51	6.61	17.48
Total actual research expenditure	0.10	0.59	2.39	6.80

Sources: Calculated from Nepal, Ministry of Finance, *Budget Speeches*, various fiscal years (Kathmandu: MOF, various years); Nepal, Auditor General's Office, *Auditor General Annual Report*, various issues (Kathmandu: AGO, various years); Nepal, National Planning Commission, *Agriculture Plans and Programs for 1982/83* (Kathmandu: NPC, 1982); and Nepal, Ministry of Finance, *Economic Survey*, various issues (Kathmandu: MOF, various years).

[a] The agricultural sector comprises agriculture, irrigation, forestry, land reform, and cadastral survey.

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[23] Peter A. Oram and Vishva Bindlish, *Resource Allocations to National Agricultural Research: Trends in the 1970s* (The Hague and Washington, D.C.: International Service for National Agricultural Research/International Food Policy Research Institute, 1981).

[24] World Bank, *Agricultural Research Sector Policy Paper* (Washington, D.C.: World Bank, 1981).

Budgetary Procedure

Budget expenditure in Nepal is classified under 12 major items, with some subitems (see Appendix 1, Table 47). The budget allocation is not based on the research projects. According to a treasury rule introduced in 1981, funds are released every four months through the District Treasury and Controller Office (DTCO). Financial control is strictly enforced in terms of total expenditure vis-à-vis total budget and of the expenditure under different items. Authority for transferring the budgeted expenditure from one item to another, as well as from one development activity to another, lies ultimately with the Ministry of Finance. The internal auditor of DTCO must audit the expenditure of the first four months (first installment) before the money is released for the second installment. From 1970/71 to 1980/81, the average annual released money for expenditure on agricultural research was only 71 percent of the planned allocated annual budget. The inflexibility in transferring funds and a long transfer process discourage researchers from undertaking any research into a problem that may have been identified in the current year.

The above analysis indicates that, despite the high priority given the agricultural sector in previous five-year plans, the financial allocation to the agriculture component of the sector is relatively low. Government priorities for agricultural research are apparent in the inadequate resources being invested in the national agricultural research system. Sixty-five percent of the budgeted agriculture research expenditure is spent to provide support services to production, leaving only 35 percent for actual research.

Trained Agricultural Personnel

Between 1970/71 and 1979/80, the trained personnel in agriculture increased by almost 2.5 times. In 1970/71, the total number of trained personnel was 1,397,[25] of which 352 employees were at the high level (officer rank) and 1,045 at the low level (junior technicians and junior technical assistants or their equivalents). The minimum training requirement for an officer-rank employee is an undergraduate degree in agriculture or the equivalent. In 1979/80 the total number of trained personnel in agriculture was 3,383, of which 873 employees were at the high level and 2,510 at the low level. Further breakdown of trained personnel in 1979/80, by department, is presented in Table 19. About 95 percent of the total trained personnel were

Table 19—Total trained agricultural personnel, 1979/80

Organization	High Level[a]	Low Level[b]	Total
Within the Ministry of Agriculture			
Ministry Secretariat	22	0	22
Department of Agriculture	442	1,761	2,203
Department of Livestock and Animal Health	108	268	376
Department of Food and Agricultural Marketing Services	53	0	53
Corporations	148	421	569
Subtotal	773	2,450	3,223
Outside the Ministry of Agriculture	100	60	160
Total	873	2,510	3,383

Source: Nepal, Agricultural Projects Services Center, *Trained Manpower for the Agricultural Sector*, vols. 1 and 2, (Kathmandu: APROSC, July 1981).

[a] Class 1, 2, and 3 officers. A graduate in agriculture begins work as a Class 3 officer.

[b] Junior technicians and junior technical assistants.

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[25] Nepal, Ministry of Agriculture, *Ten-Year Agriculture Plan* (Kathmandu: MOA, 1972).

employed in the Ministry of Agriculture and its allied institutions. The Department of Agriculture alone employed 65 percent of the total trained personnel. The agricultural institutions, namely, the Agriculture Inputs Corporation, Agriculture Development Bank, and Agricultural Projects Services Centre, are semiautonomous agencies. Outside the Ministry of Agriculture, the largest employer was the Institute of Agriculture and Animal Science under Tribhuvan University.

The number of trained personnel in agricultural research, agricultural extension, and agricultural education in 1979/80 is given in Table 20, which indicates that 44 percent of high-level trained personnel were engaged in agricultural research, 21 percent in extension, and 8 percent in education. Of low-level personnel, 59 percent were employed in extension service and 23 percent in agricultural research. Though a large proportion of high-level trained personnel was employed in agricultural research, the work of those employees was related more to extension than to research. (This was explained in the earlier discussion of budget and time allocation of researchers.)

The number of trained personnel working in various fields of agricultural research in 1979/80 is shown in Table 21. At that time, there were 104 Class 1 and Class 2 officers and 284 Class 3 officers. Employees of officer rank are divided into special, first, second, and third classes. A graduate in agriculture begins his career as a Class 3 officer.

Crops, livestock, and horticulture accounted for about 75 percent of the total research staff and 82 percent of the total budgeted research expenditure (Tables 16 and 21). The greatest concentration of research personnel was in crop research, which accounted for about 41 percent of the officer-level researchers and 38 percent of the total research expenditure, followed by livestock with 17 percent of researchers and 24 percent of research expenditure, and horticulture with 17 percent of researchers and 20 percent of research expenditure.

The data in Table 21 also include researchers who did not have undergraduate degrees in agriculture but were promoted to officer level on the basis of seniority. On average, there were 1.5 research assistants per research worker.

A 1983 survey by the author of personnel in agriculture indicated that there were 1,052 employees with baccalaureate or higher degrees, of whom 34 had Ph.D.'s, 414 had master's degrees, and the remaining 604 had B.S. degrees. Within the Ministry of Agriculture and its parastatals, there were 964 degreed personnel, of whom 29 had Ph.D.'s, 351 had M.S.'s, and the remaining 584 had B.S. degrees (see Appendix 1, Tables 48 and 49). Agricultural economics dominated all other disciplines in the number of employees with Ph.D. and M.S. degrees (Appendix 1, Table 49). The majority of these officials worked at the Agricultural Projects Services Centre.

In all, about 400 trained high-level personnel worked in agricultural research; almost half of them had postgraduate degrees. Of the 14 Ph.D.'s, 10 held administrative posts. Since an administrative post, such as chief of a section or department, is more lucrative and higher in status, personnel with Ph.D.'s will seek these positions. As their numbers increase, however, most of them will probably be employed full time in conducting research. The Ph.D. component now constitutes only 4 percent of the personnel in agricultural research—well below the target of 20 percent suggested by the World Bank.[26] The weakness in the national research system for conceptualizing, planning, and directing research may be due partly to such a low percentage of Ph.D.'s in the system. A breakdown by discipline shows that the plant sciences have 60 percent of research staff who hold B.S. degrees and above, while livestock has only 15 percent of the total research staff (see Table 22).

Training

The Institute of Agriculture and Animal Science is the only institute that offers middle- and high-level training in agriculture. All training for junior technicians and junior

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[26] World Bank, *Agricultural Research Sector Policy Paper.*

Table 20—Trained personnel in agricultural research, extension, and education, 1979/80

Category	High Level[a]	Percentage of High Level	Low Level[b]	Percentage of Low Level	Total	Percentage of Total
Agricultural research	388	44	586	23	974	29
Agricultural extension	184	21	1,480	59	1,664	49
Agricultural education[c]	73	8	4	. . .	77	2
Total	645	73[d]	2,070	82[d]	2,715	80[d]

Source: Unpublished data collected by the Agricultural Projects Services Center, Nepal, for a study of trained personnel in the agricultural sector.

[a] Class 1, 2, and 3 officers. A graduate in agriculture begins work as a Class 3 officer.

[b] Junior technicians and junior technical assistants.

[c] Institute of Agriculture and Animal Science.

[d] Twenty-seven percent of high-level and 18 percent of low-level trained agricultural personnel are otherwise employed in such organizations as the Agricultural Development Bank and the Department of Irrigation, Hydrology, and Meteorology and as administrators in the Ministry of Agriculture.

Table 21—Trained personnel in agricultural research, by rank and research category, 1979/80

Research Category	High Level[a]				
	Classes 1 and 2	Class 3	Subtotal	Low Level[b]	Total
Crop[c]	45	114	159	202	361
Livestock	20	46	66	148	214
Horticulture	17	49	66	99	165
Fisheries	6	24	30	55	85
Food science and nutrition	5	15	20	20	40
Input	8	24	32	37	69
Socioeconomic	3	12	15	25	40
Total	104	284	388	586	974

Source: Unpublished data collected by the Agricultural Projects Services Center, Nepal, for a study of trained personnel in the agricultural sector.

[a] A graduate in agriculture begins work as a Class 3 officer.

[b] Junior technicians and junior technical assistants.

[c] Includes the research staff of disciplinary sections, such as entomology, plant pathology, soil science, agricultural botany, and agricultural engineering.

Table 22—Trained officers in agricultural research, by education and discipline, 1979/80

Subject	Ph.D.	M.S.	B.S. or Equivalent	Total
Agronomy	2	20	55	77
Botany	3	10	10	23
Horticulture	1	18	40	59
Plant pathology	1	14	21	36
Entomology	1	13	7	21
Soil science	0	13	7	20
Fisheries	0	14	8	22
Agricultural engineering	0	5	22	27
Agricultural economics	3	22	0	25
Livestock and veterinary science	1	12	47	60
Food science and nutrition	2	16	0	18
Total	14	157	217	388

Source: Unpublished data collected by the Agricultural Projects Services Center, Nepal, for a study of trained personnel in the agricultural sector.

technical assistants is conducted within Nepal. The institute started a program for a B.S. degree in agriculture in 1977 and graduated the first group of students in 1979. The present enrollment capacity for undergraduate training is about 100. All graduate training (M.S. and Ph.D.), except in the social sciences, takes place in foreign countries.

The institute's staff comprises 5 Ph.D.'s, 53 M.S.'s, and 20 B.S.'s. The real expenditure of the institute increased at the rate of only 1.8 percent annually between 1972/73 and 1980/81. During this period, the average real annual expenditure was only Rs 1.6 million. Thus the training component of agriculture, like research, suffers from a shortage of financial resources and Ph.D. staff. Both research and training have received low priority, even though they play a significant role in the development of agriculture.

6

RESEARCH MANAGEMENT AND INCENTIVES

Motivation of researchers is the key to productive agricultural research. The strengthening of agricultural research systems is often thought of in terms of training, building research laboratories, and other physical facilities, without regard for the human element, which is the key to performance. The essence of good management is to keep employees interested and motivated in their work. This can be brought about through a reward system based on work performance.

Researchers in Nepal are performing much below their capacity. Interviews with a selected group of them have highlighted some problems and issues related to management and incentives in agricultural research.

Researchers' Opinions of Management and Incentives

In Nepal, government employees are classified into two broad categories, gazetted and nongazetted. Employees of the officer rank fall under the gazetted category. Gazetted officers are further grouped into four classes: special, first, second, and third. Graduates in agriculture begin their careers as Class 3 officers. Technical professionals are rarely promoted to the special class, since it is restricted to the general administrative cadre. Permanent government secretaries are considered special class employees.

A total of 120 researchers from different disciplines and geographical regions were interviewed. There were 10 Class 1, 24 Class 2, and 86 Class 3 officials. About 10 percent were women. In terms of academic qualifications, there were three Ph.D.'s, 52 M.S.'s, and 60 B.S.'s (agriculture) or the equivalent. Promotion between classes takes many years. All Class 1 officials had served more than 20 years. Six Class 2 officials had served for more than 20 years, 17 for between 11 and 20 years, and only one for less than 10 years. In Class 3, 6 had served more than 20 years, 33 from 11 to 20 years, 13 from 6 to 10 years, and 34 for less than 5 years (see Table 23).

Table 23 also shows a high frequency of personnel transfer in research work. Fifteen officials of Classes 1 and 2 had been transferred more than three times, 5 were transferred three times, and 9, two times. Thirty-four of the 86 Class 3 officials had been transferred two or more times.

Table 23—Classification of 120 research officers by sex, education, and number of years and transfers in service

	Officer Class[a]			
Category	1	2	3	Total
	(number of researchers)			
Sex				
Male	10	19	78	107
Female	0	5	8	13
Education				
High school	0	1	4	5
B.S.	2	4	54	60
M.S.	6	18	28	52
Ph.D.	2	1	0	3
Outside training[b]	5	15	23	43
Years in service				
0–5	0	0	34	34
6–10	0	1	13	14
11–20	0	17	33	50
More than 20	10	6	6	22
Transfers in service				
0	0	0	30	30
1	0	5	22	27
2	3	6	18	27
3	2	3	9	14
More than 3	5	10	7	22

Source: Interviews with 120 agricultural researchers in Nepal.

[a] Graduates in agriculture begin their careers as Class 3 officers.

[b] Nondegree education, such as a participant training program, for periods of 1–12 months.

When researchers were asked for their opinions of existing promotional rules, only 25 percent were satisfied (see Table 24). In another study, 61.5 percent of 307 officers surveyed disliked the present pattern of promotion because of defective evaluation systems and frequent rule changes.[27] A longtime resident adviser on agricultural research in Nepal, Dr. Wayne Freeman, made the following comment on the promotion system:

> The system of promotion with the Department of Agriculture is slow and cumbersome. . . . The promotion system lacks objectivity and is subject to pressures and manipulation. "Fighting for promotion" is not an idle expression, but is literally, if not physically, true.[28]

Table 24—Researchers' opinions of promotion rules

Opinion	Officer Class 1	2	3	Total
	(number of researchers)			
Satisfactory	1	8	21	30
Unsatisfactory	9	14	56	79
No opinion	0	2	9	11

Source: Interviews with 120 agricultural researchers in Nepal.

The majority of the researchers interviewed said that their authority, accountability, flexibility, status, and salary were inadequate. Almost everyone favored higher levels in those areas but claimed that their responsibilities were already high (see Table 25). It is important to note that although the responsibility given to researchers is high, their accountability is relatively low, which implies some lack of concern about completing assigned work. Similar results were found in another study, which inferred that "job performance at present is unsatisfactory and is suffering from lack of adequate authority, accountability, status, and salary."[29]

About 64 percent of the researchers spent 50 percent or less of their time in research. Only 9 percent of the researchers spent all their time on research. Seventy percent spent time in administration, extension work, or both, and 54 percent felt that their time was not properly allocated. Consequently, 83 percent indicated that their time should be geared more to research (see Tables 26, 27, and 28).

Table 25—Researchers' ratings of job-satisfaction criteria

Criterion	Present Self-Rating			Preferred Self-Rating		
	High	Moderate	Low	High	Moderate	Low
	(percentage of researchers)					
Authority	6	37	57	69	31	0
Responsibility	54	40	6	86	14	0
Accountability	25	36	39	54	36	10
Status	10	43	47	70	30	0
Flexibility	10	36	54	55	40	5
Salary	2	13	85	81	17	2

Source: Interviews with 120 agricultural researchers in Nepal.

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[27] T. B. Shrestha, *Job Environment and Job Consciousness of Agricultural Graduates Under the Ministry of Food, Agriculture and Irrigation (1978-79)* (Kathmandu: Agricultural Projects Services Center, 1980), p. 2.

[28] U.S. Agency for International Development, *Nepal Integrated Cereals Project Evaluation Report* (Kathmandu: USAID, 1983), p. 60.

[29] Shrestha, *Job Environment and Job Consciousness*, p. 6.

Table 26—Amount of researchers' time spent on research

Time Spent on Research	Officer Class 1	2	3	Total
(percent)	(number of researchers)			
100	0	0	11	11
75	2	7	23	32
50	0	2	25	27
Less than 50	8	15	27	50

Source: Interviews with 120 agricultural researchers in Nepal.

Table 27—Researchers engaged in nonresearch work

Type of Work	Officer Class 1	2	3	Total
	(number of researchers)			
None	0	0	11	11
Administration	4	6	7	17
Extension	0	2	36	38
Administration and extension	6	13	10	29
Other	0	3	22	25

Source: Interviews with 120 agricultural researchers in Nepal.

Table 28—Researchers' opinions of allocation of work time

Allocation of Time	Officer Class 1	2	3	Total
	(number of researchers)			
Present time is properly allocated				
Yes	2	8	45	55
No	8	16	41	65
More time should be devoted to research				
Yes	9	20	71	100
No	1	4	15	20

Source: Interviews with 120 agricultural researchers in Nepal.

Only 66 percent of the researchers were employed in their preferred profession. Twenty-eight percent accepted jobs in agricultural research because of a lack of alternatives, and about 40 percent preferred other jobs at the time of the study interview. About 68 percent had not published a research report in the last five years (1976-81). Since the research papers published from research project assignments are not considered in promotions, there is no motivation to publish or write research monographs. Only 20 percent of the researchers had written two or more research reports in the last five years. About 17 percent of the researchers had not had a research project during that period, and 18 percent had done only one research project. Only a few were initiated as a result of the researchers' own interest (see Tables 29 through 32).

Research Constraints

Researchers were asked to rank the following research constraints: financial, research equipment, physical facilities (vehicles, laboratories, space, libraries, etc.), supporting staff, inadequate staff, lack of guidance and supervision, and lack of clear research policies and programs.

The three highest rankings were considered for analysis. The first was weighted the highest by assigning it three points; the second was assigned two points; and the third, one point. The points were aggregated in each category. It was found that inade-

Table 29—Researchers' reasons for accepting present positions

Reason	Officer Class 1	2	3	Total
	(number of researchers)			
Own interest	6	18	55	79
No alternatives available	3	5	25	33
Other	1	1	6	8

Source: Interviews with 120 agricultural researchers in Nepal.

quate physical facilities and lack of clear research policies and programs were considered the most important constraints to research. A shortage of research equipment and a lack of budgetary support ranked third and fourth, respectively (see Table 33). It is interesting to note that researchers did not consider the lack of supporting staff or inadequate staff as a major constraint despite the fact that these are pointed to in many external evaluations of research.

As in most developing countries, the real problems are lack of clear research policies and programs, and ineffective utilization of manpower, both of which could be corrected internally without depending upon external aid. Most researchers in Nepal are juniors who hold only undergraduate degrees and need good supervision or guidance, but about 46 percent of them said that they did not receive this in their work. Only 30 percent of Class 3 officers, who have the greatest need for guidance, indicated that they received good or excellent supervision (see Table 34). Inadequate guidance, supervision, and monitoring seem to be serious impediments in the present system.

Agricultural research is presently carried out under government departments in Nepal. In many Asian countries, research is organized under an autonomous institution such as an agricultural research council. About 88 percent of the researchers surveyed, including 94 percent of Class 1 and 2 officers, wanted research to be reorganized under such a council (see Table 35).

Motivation and Efficiency

Researchers identified the following additional factors that have adversely affected their motivation and efficiency. Low salaries are regarded as a serious problem by most of the researchers. Almost everyone suggested an increase in salaries and other allowances. The real salary and allowance of all government officers declined by 20 to 25 percent between 1970/71 and 1980/81. The decline was about 40 percent for Class 1 and 2 officers between 1962/63 and 1980/81.[30]

Table 30—Researchers' preferences for different positions

Prefer Different Position	Officer Class			Total
	1	2	3	
	(number of researchers)			
Yes	5	8	35	48
No	5	16	51	72

Source: Interviews with 120 agricultural researchers in Nepal.

Table 31—Number of researchers' projects and publications, 1976-81

Number of Projects and Publications	Officer Class			Total
	1	2	3	
	(number of researchers)			
Research projects				
0	3	2	15	20
1	2	8	12	22
2	0	6	22	28
3	3	4	7	14
More than 3	2	4	30	36
Publications				
0	5	12	64	81
1	3	6	6	15
2	0	2	8	10
3	0	1	4	5
More than 3	2	3	4	9

Source: Interviews with 120 agricultural researchers in Nepal.

Table 32—Initiators of researchers' current experiments

Initiator	Officer Class			Total
	1	2	3	
	(number of researchers)			
Self	1	5	10	16
Colleagues	4	5	13	22
Chief	1	5	30	36
Self and chief	0	3	11	14
Colleagues and chief	0	0	9	9
No reply	4	6	13	23

Source: Interviews with 120 agricultural researchers in Nepal.

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[30] Nepal, *Pay Commission Report* (Kathmandu: Government Press, 1983).

Table 33—Researchers' ranking of constraints to research

Constraints	Researchers' Ranking I	II	III	Total Score[a]
	(number of researchers)			
Financial	23	18	18	123
Research equipment	19	25	21	128
Physical facilities	30	19	21	149
Supporting staff	10	18	21	87
Inadequate staff	18	10	17	91
Lack of guidance and supervision	8	24	10	82
Lack of clear research policy and program	33	14	15	142

Source: Interviews with 120 agricultural researchers in Nepal.

[a] Total score was computed on the basis of values assigned: Rank I = 3, Rank II = 2, Rank III = 1.

Table 34—Researchers' rating of research guidance from supervisor

Rating	Officer Class 1	2	3	Total
	(number of researchers)			
Excellent	1	2	8	11
Good	7	5	18	30
Fair	0	5	18	23
Poor	0	3	12	15
No proper supervision	2	9	30	41

Source: Interviews with 120 agricultural researchers in Nepal.

Table 35—Researchers' preferred organization of research bodies

Existing Research Organization	Officer Class 1	2	3	Total
	(number of researchers)			
Stay as is, with government	1	1	12	14
Reorganize into autonomous institution	9	23	74	106

Source: Interviews with 120 agricultural researchers in Nepal.

Because of a lack of job descriptions and poor definition of responsibilities, researchers work mostly on verbal instruction from their supervisors. Frequent changes in their assigned tasks result in low motivation and an atmosphere that is not conducive to serious research.

Researchers complained that their work is not evaluated regularly and objectively. The current practice of evaluation of researchers by their supervisors to meet the requirements of the Public Service Commission regarding promotion does not reflect their actual performance (this problem is discussed in the following section on promotion rules). Researchers stated that an objective and impartial evaluation, if done regularly, would motivate them to work harder. The present system of evaluation has only encouraged inefficiency and incompetency.

Senior researchers and sectional chiefs said that they cannot make purchases of small items or materials needed for their research without the approval of higher authority. Sometimes they must delay their work while their request for action goes through the cumbersome process of approval. They indicated that the delegation of some financial and administrative authority to them would greatly improve their performance.

Almost all researchers (92 percent) expressed the need for a high-level college degree or short-term specialized training, or both, as prerequisites to becoming effective researchers (see Table 36). Fifty-five

Table 36—Researchers' desire for further training

Type of Training	Officer Class 1	2	3	Total
	(number of researchers)			
None	2	2	4	8
Higher degree	4	14	41	59
Short-term training	3	3	26	32
Higher degree and short-term training	0	4	15	19
Other[a]	1	1	0	2

Source: Interviews with 120 agricultural researchers in Nepal.

[a] Training such as a study tour of 2–4 weeks.

percent of the researchers have only a B.S. in agriculture or the equivalent. The common feeling among researchers was that the minimum level of training for a research worker should be an M.S. Only at the M.S. level of training does a person learn research methodology and statistical analysis and carry out a research project independently. There was also concern about the acute shortage of researchers with Ph.D. training to provide leadership and guidance in research. Presently there are only 14 Ph.D.'s in the entire research system, and most of them occupy administrative positions. Ruttan points out that

> At the beginning, when only limited professional capacity is available, there is a tendency for research staff to move from research into administrative and policy positions after a short research or teaching career. The capacity to provide a continuous stream of replacements is essential to the continued viability of the research efforts.[31]

The interviews also showed that junior researchers do not receive adequate guidance and supervision in their work from senior researchers.

The lack of research publication facilities is a serious constraint in promoting agricultural research in Nepal and has received little attention at the higher levels of administration. A large quantity of data has been generated by the researchers but retained only in files that are destroyed after a few years. Lack of financial support for the publication of the Nepal Journal of Agriculture and other scientific journals, and nonrecognition for promotion purposes of publications resulting from assigned research have led to this dismal situation. Researchers view publication of their research work as an important factor in boosting their work and confidence.

The research staff who work in the system on a temporary basis for a year or more were found to have the lowest level of morale or motivation. They are neither certain to continue in the field of research where they are currently employed nor eligible for any training opportunities or long-term employment benefits. The cumbersome and long process of creating permanent posts in the government and recruiting staff through the Public Service Commission delays the appointment of permanent staff. Even when they are recruited, their individual research interests are not taken into consideration.

Most researchers expressed dissatisfaction with the current promotion rules and long delays in promotion (Tables 23 and 24). They expressed serious doubts about prospects for any improvement in the current rules and for their timely promotion under the present structure. They indicated that only autonomous research institutes would be able to formulate and execute personnel policies designed to meet research requirements.

Almost all the technical sections, research stations, and farms have ill-equipped library facilities. Most of the researchers expressed the need for good library facilities to assist them in their research work and publications. Presently, research stations receive only Rs 1,000 annually for the purchase of books, journals, and newspapers.

The role of leadership in promoting any organization is extremely important. Researchers expressed a need for administrators who have vision and who could provide intellectual leadership in shaping the overall research program. Researchers strongly urged that such a person be identified and appointed to lead the research system.

Promotion Rules

Existing promotion rules contain some serious problems that hamper research. Four factors are considered in evaluating a researcher in Nepal. They are length of service; education, training, and research publication; work performance and capability; and experience. The evaluation methods are designed objectively, using numbers for each factor. A gazetted officer in the government is eligible for promotion after five years of service in a particular class. For every year of service an officer receives eight points.

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[31] Vernon W. Ruttan, *Agricultural Research Policy* (Minneapolis: University of Minnesota Press, 1982), p. 177.

The evaluation of education is done from high school through the Ph.D. For each certificate, diploma, or degree, the points given for graduating in the first, second, or third division are 24, 20, and 16, respectively. A Ph.D. degree is always assigned 24 points. For in-service or foreign training exceeding a month, an officer receives a maximum of 10 points. For a research publication, a maximum of 10 points is given. However, it is important to note that researchers cannot claim points for publications resulting from assigned work. This seems unreasonable because a researcher should be evaluated on the basis of his research output, which is usually a research report. The failure to assign credit for such publications may be one of the reasons researchers in Nepal are not motivated to publish the findings of their research.

Work performance and capability evaluations are done by supervisors. An evaluation requires two separate forms; one to evaluate the work performed by the individual every six months and the other to evaluate an individual's capabilities and other attributes annually. The maximum number of points allocated for each form is 60. The supervisor generally gives 48 or less points because if he gives more than 48 points he is required to justify the excellence of the employee's work, and this must be agreed to by the reviewer, a senior person, and finally approved by the chief secretary of the government. Also, the evaluated individual is required to give his or her consent to the evaluation score. To avoid creating tension among his subordinates, the supervisor usually gives everyone a total at or around 96 points.

The scoring of experience is based on the location of the employee in the country, which is divided into five geographical regions according to the difficulties caused by the physical terrain and the unavailability of services and amenities. In the most difficult region, an employee gets eight points for every year of service. In the least difficult region, only one point is given for every year of service. The middle three regions are assigned six, four, and two points, according to their ranking. The maximum number of points an officer can earn throughout a career is 40, and it is this restriction that causes researchers to feel the promotion rules are heavily stacked against them. Most of the research stations and laboratories are located in the least difficult region. Also, specialized research work does not permit transfers of researchers to different places, unlike administrative or extension work. Better ways could be found to compensate employees for working in difficult areas; for instance, monetary compensation would be more appropriate than points.

The current promotion rules have been designed primarily for employees of the General Civil Service and are inappropriate for researchers. Promotion rules for researchers need to be designed with the field of research in mind. This is possible only if a research organization separates itself from the general administration of the government, thus gaining control over the design of its personnel policies, recruitment, and promotion system. This autonomy is extremely important for the success of the research system.

Job Security

Government employees feel secure in their jobs. Shrestha found that only about 12 percent of the respondents complained about being insecure in their jobs.[32] A permanent employee being dismissed because of poor performance on the job is unheard of. The worst penalty imposed is transfer to difficult geographical areas. If an employee has links with a power group in the government, such a transfer can easily be nullified.

Publication

Publication of research articles universally provides both recognition and personal satisfaction to researchers. Researchers' performances are generally evaluated by the quality and quantity of their publications in research journals, so publication is an extremely important activity in a research system. In Nepal, this activity is seriously limited. There are currently three journals in which agricultural scientists can publish their research work. They are the *Nepalese Journal of Agriculture, Animal Health Bulletin,* and *Journal of the Institute of Agriculture and Animal Science.*

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[32] Shrestha, *Job Environment and Job Consciousness*, p. 3.

Publication of the *Nepalese Journal of Agriculture* was begun in February 1966 by the Nepal Agriculture Association. Most of the agricultural graduates are the members of the association and pay a nominal annual membership fee. The money collected is used to pay a part of the publication cost of the journal. The association published the journal regularly for five years, stopped publication from 1971 to 1975, and again published in 1976, 1977, and 1979, after which publication was again discontinued until 1986. Thus, in the 1970s, both the Nepal Agriculture Association and the publication of the *Journal of Agriculture* were almost dormant. The association was inactive because of lack of interest among its members, and the government provided no financial support for the publication of the journal. The Nepalese Council of Science and Technology, an independent organization that promotes scientific work throughout Nepal, awarded Rs 5,000 to the *Nepalese Journal of Agriculture* in 1977 for being an outstanding scientific journal. This indicates the potential for such a journal, but lack of funds precludes its regular publication.

The Nepal Veterinary Association began annual publication of the *Animal Health Bulletin* in 1977. This association is relatively more active than the Nepal Agriculture Association but faces similar financial constraints in publishing its bulletin regularly.

The Institute of Agriculture and Animal Science began publishing its journal in December 1977. The institute finances the publication of the journal and publishes it annually.

A total of 94 articles have been published in the *Nepalese Journal of Agriculture,* 23 in the *Journal of the Institute of Agriculture and Animal Science,* and 30 in the *Animal Health Bulletin.* The lack of support for the publication of journals demonstrates the low priority accorded to research in Nepal.

Staff Instability

Staff instability is not a serious problem in Nepal, since there are few job opportunities for agricultural technicians outside the public sector. Also, the Public Service Commission discourages movement of staff from one discipline to another. However, the instability of agricultural economists is high compared to other disciplines because job opportunities for agricultural economists are greater than for other agricultural disciplines.

Though staff instability does not seem to exist in terms of leaving the research institute, frequent transfer of staff is a serious problem. For instance, a serious manpower constraint is reported in the national rice development program because most of their trained personnel have been transferred to other posts and new staff must be recruited and trained.[33]

Instability at Policy and Managerial Levels

Frequent transfers of officials at the policy and managerial levels have also adversely affected the development of agriculture in Nepal. In a 16-year period (1967-83) there were 16 ministers of agriculture. Of the 16, 8 served less than a year and the remaining 8 served between one and two years. Similarly, in a 14-year period (January 1969 to October 1982) there were 9 permanent secretaries in the Ministry of Agriculture. Of the 9, 4 served less than one year; 2, between one and two years; and 3, between two and three years. As for directors general of agriculture, there were 4 in the nine years from 1972 to 1981. The positions of joint secretary for planning in the Ministry of Agriculture and director general of the Food and Marketing Services Department, which hold the main responsibility for agricultural planning and socioeconomic studies, both had 5 occupants within nine years. From the early 1970s to the early 1980s, the average period that the heads of the Agricultural Input Corporation, the Agricultural Development Bank, and the Agricultural Projects Services Center remained in their posts was two to three years. The deputy directors general of Agricultural Research remained in office for about four years.

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[33] Nepal, Department of Agriculture, *The Integration of Research and Extension in Farmers' Fields: The Terminal Report of the Integrated Cereals Project* (Kathmandu: Ministry of Agriculture, 1985), pp. 54-55.

Research policies and priorities are determined in the Ministry of Agriculture; the deputy director general merely carries out those policies. Thus, during the 1970s, frequent changes in personnel at the helm caused great instability in agricultural policies and programs. The frequent juggling of senior positions subsequently brought changes to the lower level of administration as well.

Instability at policy planning and executive levels also leads to administrative inefficiency. An employee may feel secure as a government employee but be vulnerable in a particular position. Therefore, officials use their energy and talents in soliciting sociopolitical support to ensure their continuity in the current position and, if possible, for advancement to higher levels. In this process, these officials are more likely to yield to sociopolitical pressures. Freeman's observation is noted here:

> . . . [the] Department of Agriculture is subject to political pressures and changes in many ways. The Director General is frequently replaced and the policies and even the administrative structure of the department are subject to change. Within the Department of Agriculture those responsible for administering research are burdened with day-to-day problems and political pressures so that research management occupies only a small portion of their time.[34]

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[34] U.S. Agency for International Development, *Integrated Cereals Project*, p. 59.

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AGRICULTURAL RESEARCH PRIORITIES AND STRUCTURE: SOME CONCLUDING OBSERVATIONS

Agricultural development is an extremely complex process. It is the balanced combination of prices, technology, infrastructure, and institutions that promotes and sustains production growth. Although all these elements are important, the pivotal factor in modernizing traditional agriculture is improved agricultural technology, without which the effectiveness of other factors remains weak.

Although Nepal is a small country, it has considerable agroclimatic variation. In the mountains, for example, there are many microregions with differing conditions. A crop variety suitable for one microregion may not be suitable for another, and the transferability of agricultural research recommendations is limited.

Opportunities for borrowing and adapting research results from abroad may be particularly advantageous for rice, maize, wheat, sugarcane, and jute cultivation in the Tarai, which is part of a large agroclimatic subregion that receives substantial research attention from international and other national research institutes, but such opportunities are extremely limited for the hill and mountain regions. The development and management of agriculture and natural resources in the hills, where 56 percent of the population subsists on only 43 percent of the cultivated land, will depend much more on indigenous development of appropriate agricultural technology that is location-specific, but there is little relevant technology to draw on from other similar areas. Worldwide high-altitude agriculture is difficult and has been neglected.

Although the short-term returns on this type of research investment may not compare favorably with similar expenditures on research in more prosperous areas, the continued absence of appropriate research for the hill region is likely to result in adverse conditions for income distribution and in resource depletion of the country as a whole. Agricultural production and productivity have deteriorated much faster in the hills than in the Tarai. The food, fuel, and fodder requirements of the large and increasing human and livestock populations are leading directly to serious depletion of natural resources and to erosion through forest degradation, overgrazing, and cultivation on steep slopes. This erosion causes siltation and flooding problems in the Tarai and beyond Nepal's borders. To prevent ecological degradation, the specific areas for research would be agroforestry, forage and fodder, terracing, erosion control, soil fertility, and genetic improvements of indigenous varieties. To promote commercialization of agriculture, research on mountain infrastructure (transport), storage, agricultural marketing for inputs and outputs, and subsistence versus cash crops is crucial. When looked at in the longer term, the potential returns on investments in appropriate hill region research are substantial.

Agricultural research priorities and strategies should generally follow the overall strategy of agricultural development in Nepal. The long-term development strategies of agriculture are correctly identified in the Fifth Five-Year Plan on the basis of comparative advantages in regional specialization, whereby the predominant economic activities would be horticulture and livestock production in the hills and mountains and foodgrain production in the Tarai.

The absence of a systematic program to carry out long-term national research strategies and priorities in accordance with regional specialization has led to various ad hoc agricultural research programs in which there is no direction and allocated resources are not used for actual research purposes. The potential returns on a carefully planned research program and on investments are considerable.

The food balance report of the Food and Agricultural Marketing Services Department indicates that 28 of the 55 hill districts had food deficits in 1974/75, 38 had deficits in 1978/79, and 47 in 1982. In the long run the Nepalese hills are unlikely to be self-sufficient in foodgrain because of a continuous decline in agricultural productivity that is exacerbated by a diminishing scope for expanding cultivated areas and by the increasing population in the hills. It should also be recognized that the hills contain a large upland region devoid of irrigation and with soil that is very low in plant nutrients. Approximately 80 percent of cultivated land in the hills is upland and more than 90 percent of the cultivated land is unirrigated. Therefore, dramatic increases in foodgrain production are unlikely. However, improving cereal production in the valleys and lowland is possible by raising crop yields, especially where yields are still at traditional levels.

Production technologies for rainfed upland agriculture are yet to be developed. A high level of investment in agricultural research pertaining to the diverse conditions of the hill area will be needed to develop agricultural technologies that will increase yield and improve soil conservation and management. Agricultural research must be central to the design of development strategies for the hills.

Any significant boost in crop production in Nepal must come from the Tarai.[35] Here the potential for improving yields in foodgrains and cash crops through increased application of improved seeds, fertilizers, pesticides, irrigation, and water management is substantial. In the past, increases in Tarai foodgrain production have resulted almost entirely from increases in cropped areas. The scope for further increasing land under cultivation is extremely limited, since this would be possible only at the cost of reclaiming land from forestry. Thus an increase in foodgrain production must largely come from increasing productivity through promotion of irrigation, greater intensity of cropping, and development and dissemination of improved agricultural technology. A substantial investment will be needed to increase irrigation facilities, build agricultural research capabilities, and establish production support programs such as extension, input, credit supply, and marketing.

The following conceptual framework for complementarities in production between the hills and the Tarai is suggested. A higher production of foodgrain in the Tarai could generate a large marketable surplus. With proper infrastructural support, this surplus could benefit hill people in two ways. First, present constraints on wage goods that are essential for an employment-intensive program could be released. Low-income people spend the bulk of their additional income on food, and a high-employment policy increases the income of the poor, whose demand for food subsequently increases.[36] This increase in demand for food could be met from the marketable surplus generated in the Tarai. Second, the surplus would have an effect on the domestic prices of foodgrain, depending upon the quantities exported. It is commonly believed that benefits of technological innovations in the production of foodgrains for which the demand is inelastic are passed to consumers, particularly the urban population and hill people in the case of Nepal.

Conversely, the hills will produce fruits and vegetables, livestock products, and handicrafts, the demands for which are elastic. In the production of such commodities, the benefits of technological innovations are passed to the producers. Thus, technological innovations in foodgrain production in the Tarai will not only benefit Tarai producers through an increase in production but will also benefit the hill people, who are potential consumers and will benefit further from technological innovations in horticulture, livestock, and the cottage industries.

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[35] International Fund for Agricultural Development, *Report of the Special Programming Mission to Nepal.*

[36] John W. Mellor, *The New Economics of Growth: A Strategy for India and the Developing World,* a Twentieth Century Fund Study (Ithaca and London: Cornell University Press, 1976).

The hills and mountains have a comparative advantage in the production of horticulture and livestock products. However, there is a serious lack of improved technology and marketing for both subsectors. Farmers will undertake horticultural and livestock activities on a commercial scale only if the marketing of their products is guaranteed. Both horticulture and livestock are of special significance to the poor and to small farmers in terms of employment and income, since they are more labor intensive than foodgrains, both on and off the farm.[37]

Because of the perishability of these commodities, rapid transportation is essential. Therefore, an intensive program of horticulture and livestock development should be initially concentrated in a few hill and mountain pockets that have access to a good transport network. This program could gradually expand to other regions as transport and marketing networks develop. Also, the intensity of research on horticulture and livestock is very low. To pursue more diversified high-value and low-volume agricultural products, as postulated by the government, would place high demands on the agricultural research system in the hills.[38] The prerequisite for realizing this strategy is the provision of access to markets. This access will require massive investments in the development of transport and marketing networks linking the hill economy with the Tarai and with foreign markets.

Thus the development of transportation, marketing networks, and research is essential to hill development. Regional specialization, Tarai-hill integration, and trade become pivotal in the long-term agricultural development strategy of Nepal. In planning policies, care should be taken that short-term imperatives do not run counter to the long-term development potential of Nepal. For instance, every year more hill districts are becoming food-deficit districts, and the immediate national concern has been to turn all efforts toward increasing food production in the hills, albeit without much success. These efforts have diverted attention and resources from the long-term potential of horticulture and livestock development to the short-term imperatives of foodgrain production in the hills. Horticulture and livestock have attracted little or no attention from the bilateral and multilateral agencies. Without a policy change in priorities toward research and development programs for these two subsectors, the current trends of agricultural expansion into marginal lands for foodgrain production, rapid rates of deforestation, and rising population are likely to have even more serious consequences for the environment.

The allocation pattern of research expenditures between the hills and the Tarai to a large extent reflects regional specialization. For example, from 1970/71 to 1980/81 the average annual research expenditure on crops in the Tarai was Rs 4.269 million compared to Rs 0.852 million in the hills, indicating a greater research effort on food crops in the Tarai than in the hills. But the average annual research expenditures on horticulture and livestock in the hills were Rs 3.665 and Rs 2.789 million, respectively, compared with Rs 0.790 and Rs 0.910 million in the Tarai. A similar pattern is reflected in the allocation of trained agricultural manpower in agricultural research. For example, in 1979/80, 95 officer-level technicians worked in crop research in the Tarai compared with only 20 in the hills, and 116 officer-level technicians worked in livestock and horticulture in the hills compared with 16 in the Tarai.

The agricultural resource allocation patterns and disciplinary orientation of the research stations and farms in different locations of the country indicate that efforts have been made to follow a broad research strategy in accordance with regional specialization. However, this strategy has not been operationally effective, largely because of the low priority given to research activities in the annual work programs of the research stations and farms. The major preoccupations of these stations and farms have been to propagate improved seeds, fruit plants, and breeds of animals and to provide training and other production support services. Research on livestock and horticulture in the hills and mountains has been almost nonexistent.

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[37] International Fund for Agricultural Development, Special Programming Mission, proposal for IFAD assistance in National Horticultural and Livestock Research Project, 1979. Proposed project did not materialize.

[38] Ibid.

Besides horticulture and livestock, other areas of research that presently receive almost no attention are factor-oriented ones such as labor, water utilization, land terracing, and soil conservation techniques; forage crops and fodder trees essential to meet the shortage of feed for livestock; grain legumes and pulses, which constitute a significant portion of the national diet and could improve the soil nutrients through nitrogen fixation; and some minor cereal crops such as finger millet, barley, and buckwheat, which are important food crops for many poor and subsistence farmers in the hills. Since only 14 percent of the total cultivated land is irrigated, farming in Nepal is largely conducted under rainfed conditions; therefore, the major crop research program should be oriented toward rainfed agriculture.

Social science is also at a low ebb. The inclusion of social scientists in the research programs of different commodities and in farming system research is essential to developing a socially acceptable and economically viable technology. Research in the area of agricultural policies is also warranted.

Types of Research

Ruttan postulates three generalizations regarding the agricultural research system for small countries. These are relevant for Nepal. First, the research investment per hectare will have to be higher in a small system than in a large one in order to achieve an equal level of effectiveness. Second, the cost of developing productive farming systems for a small country with wide agroclimatic variation will be greater than for a small, more geographically homogeneous country. Third, a small country will have to depend on others—international agricultural research systems, research systems of large countries in the same region, multinational firms—for much of its agricultural technology. However, a small country needs to develop sufficient expertise in agricultural science to enable it to draw selectively from other national and international research systems.[39]

In accordance with the induced innovation theory, research efforts should generate technology that will ease out the resource constraint that is inhibiting output expansion.[40] In Nepal, land and capital are the constraints, so research should focus mainly on biological and chemical innovations.

Since the possibility of borrowing technology from neighboring countries and international agricultural research centers is greater for the Tarai than for the hills, Nepal would benefit by emphasizing adaptive research in the Tarai in order to test or verify the suitability of these technologies. At the same time, the government could emphasize both strategic and adaptive research in the hills to develop and modify agricultural technology suitable to the hill environment. The technology-borrowing capacity of the research system could be enhanced through active efforts to acquire current journals and other research reports, and to visit and collaborate with research systems in neighboring countries and at international agricultural research centers. Also, varietal, plant protection, and agronomical trials are needed as prime activities of Tarai agricultural research. On the other hand, the most important focus for hill research is the generation of new technology, which would require an increased number of qualified plant and animal breeders as well as improved laboratory facilities.

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[39] Vernon W. Ruttan, *Agricultural Research Policy,* pp. 177-178.
[40] Ibid.

The development of a viable, sustainable, and dynamic research system is a vital step toward meeting the needs of the country, and the role of foreign assistance is crucial in building such a system. Foreign aid has already provided expertise in training research personnel and building physical infrastructure in some specific components of agricultural research, but the research system as a whole is still weak, imbalanced, and underdeveloped and needs a holistic approach.

Ruttan points out that a national system designed to transfer, screen, and adapt technology requires essentially the same skills as a system devoted to the invention of new technology.[41] Therefore, advanced training should always receive high priority in building a research system that can carry both adaptive and strategic research.

Research Structure

It is evident from the earlier discussion that the Nepalese agricultural research system is poorly funded, organized, and managed. Although agricultural research is central to the success of any production support program, it has generally received lower priority than the production program. Donor assistance is readily available for the production program but not for research because research results require a long gestation period, and both donors and recipient governments want quick results or returns on their investment. Unless there is a favorable change in attitude toward research at the policy level and among donors, no substantive reform or investment can take place in research.

To substantially reform the system, the foremost prerequisite is a political will to accord high priority to agricultural research and to unify all agricultural research activities under one body. Under the present organizational structure, extension and other production support activities tend to dominate the overall program and research consequently suffers.

The experience of several other Asian countries indicates that an autonomous research organization is generally better equipped to provide an atmosphere for the necessary coordination of planning and logistical support, including attractive conditions of employment, than a research organization under government bureaucracy. An autonomous research organization can institute its own rules and regulations for staff recruitment and promotion and thereby create a better research environment. It should also have a monitoring and evaluation unit to administer the progress of research work and examine its relevancy and effectiveness.

There is some concern that reorganizing research under a separate autonomous body is likely to weaken the linkage between research and extension. However, having these two activities under the Department of Agriculture does not guarantee close coordination between them. The important consideration is that the objectives of agricultural research should be explicit, so that the research priorities and programs are related to the problems of farmers and their resources. The research system should be held accountable for its output and for the relevancy of that output. The program should be strictly monitored and evaluated so that the total research system focuses on the farmers' problems. In the past, several studies have emphasized the need for reorganization of agricultural research into a unified and autonomous structure.[42] The

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[41] Ibid., p. 175.

[42] Ram P. Yadav, "Institutional Arrangements for Agricultural Research in Nepal," in *Research, Productivity and Mechanization in Nepalese Agriculture,* ed. Bhavani Dhungana, a seminar report (Kathmandu: Center for Economic Development and Administration, Tribhuvan University, 1976); Nepal, Department of Agriculture, *A Proposal for Organizing Agricultural Research in Nepal,* Mid-term Preliminary Draft, April 7-May 27, 1977; ADB/Nepal, *Nepal Agricultural Sector;* FAO/World Bank Cooperative Program, *Nepal Agricultural Research Review Mission Report* (Rome: FAO, 1984); USAID, *Nepal Integrated Cereals Project Evaluation Report,* suggests a semiautonomous research and development institution that could provide a degree of freedom in personnel policy, fiscal policy, and research direction, and some insulation from political pressures; Report of the Joint Review Team, A Proposal for a Nepalese Council for Agricultural Research, March 1978; IFAD Programming Mission in 1979 supported the proposed National Council for Agricultural Research and recommended that IFAD support establishment of the council.

Ministry of Agriculture will have to play a coordinating role to effectively link research and extension.

The current decentralization plan of the government of Nepal requires that all sectoral development activities at the district level be coordinated and administered by the district development officer, and that technical support and guidance be provided through technical departments and ministries. Therefore, the agricultural extension program will have to be carried out by the Department of Agriculture through 5 regional agricultural directorates and 75 district agricultural development offices.

The Institute of Agriculture and Animal Science (IAAS) can play an important role in meeting the trained manpower needs for research and extension, especially if high priority is given to upgrading the training. Within 7 to 10 years the IAAS could be converted to an agricultural university and should maintain close contact with the proposed autonomous research organization through exchange of staff. Ultimately there could be complete amalgamation of the research organization into the agricultural university, bringing research and teaching together so that both research and training become mutually reinforcing and relevant.

APPENDIX 1: SUPPLEMENTARY TABLES

Table 37—Share of various sectors in development expenditures during five-year plans, 1965-85

Sector	Third Plan 1965-70	Fourth Plan 1970-75	Fifth Plan 1975-80	Proposed Sixth Plan 1980-85
	(percent)			
Agricultural[a]	17.56	21.72	25.43	30.34
Transportation and communications	31.29	41.15	27.68	19.45
Industry, mining, commerce, and electricity	10.03	14.54	18.74	25.75
Social services[b]	17.20	17.25	23.22	22.14
Others	23.92	5.34	4.93	2.32
Total development expenditure	100.00	100.00	100.00	100.00

Sources: Third and Fourth Plan data are based on World Bank, *Nepal: Development Performance and Prospects,* a World Bank Country Study (Washington, D.C.: World Bank, 1979); Fifth Plan data are from Nepal, Ministry of Finance, *Nepal: Economic Survey for FY 1980/81* (Kathmandu: MOF, 1981); and Sixth Plan data are from Nepal/World Bank, *Allocation of Development Expenditure in the Public Sector,* an economic memorandum on Nepal (Kathmandu: Ministry of Finance), Appendix E, p. 98.

[a] The agricultural sector comprises agriculture, irrigation, land reform, forestry, and cadastral survey.

[b] Social services include education, health, and drinking water.

Table 38—Total GDP, agricultural GDP, and budget expenditures, 1970/71-1980/81

Year	Total GDP	Agricultural GDP	Total Budget Expenditures	Total Development Expenditures	Total Agricultural Sector Expenditures
	(1972/73 Rs million)				
1970/71	11,266	7,605	866.0	523.3	106.6
1971/72	12,899	8,840	988.1	637.2	118.7
1972/73	11,165	7,637	982.6	608.6	120.3
1973/74	12,517	8,650	1,070.1	655.7	168.3
1974/75	12,366	8,534	1,129.7	721.8	154.6
1975/76	12,327	8,147	1,356.1	878.0	259.0
1976/77	12,212	7,342	1,646.9	1,058.9	272.5
1977/78	12,657	7,451	1,715.8	1,159.7	283.7
1978/79	13,790	8,296	1,874.9	1,228.3	332.3
1979/80	14,148	7,613	2,444.9	1,321.3	291.3
1980/81	13,631	7,701	2,031.9	1,356.1	336.1
	(percent)				
Annual growth rate	1.53	−0.57	10.67	10.89	13.56
t-statistic	3.20	−0.81	11.97	14.77	9.13

Sources: Unpublished data from National Planning Commission Secretariat and Central Bureau of Statistics, Nepal; and Nepal, Ministry of Finance, *Economic Survey,* various issues (Kathmandu: MOF, various years).

Table 39—High-yielding cereal varieties released in Nepal, 1959-85

Crop	Serial Number	Name of Variety	Origin	Year of Release	Recommended for Hill	Recommended for Tarai	Remarks[a]
Rice	1	CH-45	China	1960	x	x	Early, 1
	2	N-136	India	1962		x	0
	3	BR-34	India	1962		x	0
	4	BR-8	India	1962		x	0
	5	Taichung-176	Taiwan	1966	x		2
	6	Chainung-242	Taiwan	1966	x		3
	7	Kaoshung-24	Taiwan	1966	x		0
	8	Chainan-2	Taiwan	1966	x		0
	9	Tainan-1	Taiwan	1966	x	x	0
	10	Taichung Native-1	Taiwan	1967		x	3
	11	IR-8	IRRI	1968		x	0
	12	IR-5	IRRI	1969		x	0
	13	IR-20	IRRI	1970		x	0
	14	IR-22	IRRI	1972		x	0
	15	Khumal-1	Taiwan	1972	x		0
	16	Parwanipur-1	Taiwan	1973		x	3
	17	Jaya	India	1973		x	3
	18	Masuli (Mahsuri)	Malaysia	1973		x	1
	19	IR-24	IRRI	1975		x	0
	20	Chandina (IR532)	IRRI	1977		x	Early, 3
	21	Laxmi (IR2061)	IRRI	1979		x	Early, 2
	22	Durga (IET2938)	India	1979		x	3
	23	Sabitri (IR2071)	IRRI	1979		x	1
	24	Janaki (BG-90-2)	Sri Lanka	1981		x	1
	25	Bindeswari (IET1444)	India	1981		x	Early, 1
	26	Kanchan (IR3941)	IRRI	1982	x		1
	27	Himali (IR2298)	IRRI	1982	x		Early, 1
	28	Malika (Mala/J15)	Bangladesh	1982		x	2
	29	Khumal-3 (Ch1039XIR580)	India	1983	x		1
Maize	1	Amarillo de Cubano Flint	United States	1959	x	x	
	2	Khumal Yellow		1968	x		1
	3	Rampur Yellow		1968		x	2
	4	Kakani Yellow		1969	x		2
	5	Hetauda Composite	Nepal	1972	x	x	3
	6	Rampur Composite	Thailand	1975	x	x	1
	7	Sarlahi White	Philippines	1975		x	3
	8	Janaki Makai		1979		x	winter, 3
	9	Arun-2	UNCC XDHR	1981	x	x	1
	10	Makalu-2	(Amarillo del Bajio)	1984	x		1
Wheat	1	Lerma-52	CIMMYT	1960	x		2
	2	Petic-62	CIMMYT	1967	x		0
	3	Lerma Rojo-64	CIMMYT	1967	x		3
	4	S-331	India	1969		x	0
	5	S-227	India	1969		x	0
	6	RR-21 (Sonalika)	India	1971	x	x	1
	7	NL-30	India	1975		x	2
	8	HD-1982	India	1975		x	0
	9	UP-262	India	1979		x	1
	10	Lumbini	India	1981		x	2
	11	Siddhartha	India	1983		x	2
	12	Triveni	India	1983		x	2
	13	Vinayak	India	1983		x	2
	14	Vaskar	CIMMYT	1983		x	2
	15	Nepal 297		1985		x	

Sources: Nepal, Department of Agriculture, *The Integration of Research and Extension in Farmers' Fields: The Terminal Report of the Integrated Cereals Project* (Kathmandu: Ministry of Agriculture, 1985), p. 49; and Food and Agriculture Organization of the United Nations, *Seed Status Survey Report* (Rome: FAO, 1981).

[a] According to the FAO *Seed Status Survey Report*, the importance or popularity of varieties is categorized as follows: 1 = very important, 2 = important, 3 = less important, 0 = grown occasionally or not at all.

Table 40—Foreign-aided projects that partly support agricultural research activities in Nepal, 1982

Project	Financing Agency
Agricultural Research and Extension	International Development Association/World Bank (IDA/WB)
Cash Crop Development (sugarcane, tobacco, oilseed, ginger, sericulture)	IDA/WB
Narajani Zone Irrigation Development, Stage II	IDA/WB
Sunsari and Morang Irrigation and Drainage Development, Stage I	IDA/WB
Rasuwa-Nuwakot, Integrated Rural Development Project (IRD)	IDA/WB
Chitawan Irrigation Project	Asian Development Bank (ADB)
Kankai Irrigation Project	ADB
Sagarmatha IRD Project	ADB
Livestock Development Project	ADB
Aquaculture Development	ADB
Hill Agriculture Development	ADB
Aquaculture Development	United Nations Development Programme (UNDP)
Vegetable Seed Production	Food and Agriculture Organization of the United Nations (FAO)
Integrated Cereals Project	U.S. Agency for International Development (USAID)
Resource Conservation and Utilization	USAID
Institutional Capacity Building (to develop social-science research capability)	USAID, Agriculture Development Council, International Development Research Centre, Federal Republic of Germany
Lumle Agriculture Center	United Kingdom (UK)
Pakhribas Agriculture Center	UK
Silvicultural Research Project	UK
Tea Development	UK and ADB
National Potato Development	Switzerland
Tinau Watershed Management	Switzerland and Federal Republic of Germany
Livestock Development at Pukhara	Federal Republic of Germany
Janakpur Agricultural Development	Japan
Horticulture Development	Japan
Sericulture Development	Republic of Korea
Karnali/Bheri Integrated Rural Development (projects to collect basic data surveys and resource assessments)	Canadian International Development Agency (CIDA)
Agriculture Resource Inventory	USAID
Land Resource Mapping Project	CIDA
Water and Power Resources Development (surveys and resource assessments)	CIDA
National Farm Management Survey	FAO/UNDP

Source: Unpublished data from the Foreign Aid Division, Ministry of Finance, Nepal.

Table 41—Crop research budget expenditures, 1970/71-1980/81

Project	1970/71	1971/72	1972/73	1973/74	1974/75	1975/76	1976/77	1977/78	1978/79	1979/80	1980/81
	(1972/73 Rs 1,000)										
Technical section											
Agricultural botany	670	675	630	210	271	342	314	260	289	260	251
Entomology	457	409	325	618	436	295	334	299	534	309	280
Plant pathology	323	441	340	357	379	262	261	289	320	291	280
Entomology (Khopasi)	n.a.	n.a.	n.a.	n.a.	441	295	388	227	288	220	815
Agricultural stations and farms											
Parwanipur - crops	457	1,081	865	654	627	447	423	376	339	284	287
Tarhara - crops	305	404	698	587	333	299	347	353	267	244	235
Rampur - crops	663	765	671	502	539	283	315	316	328	265	286
Bhairahwa	780	827	281	495	198	442	311	293	300	271	270
Nepalganj	512	437	461	778	1,025	653	1,021	535	408	341	323
Jumla	217	125	75	184	121	144	131	145	143	126	105
Tikapur	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	15	32	24	25
Surkhet	n.a.	n.a.	n.a.	37	45	72	434	196	445	169	173
Doti	109	89	70	76	94	127	115	79	99	91	101
Jobari	n.a.	n.a.	n.a.	n.a.	n.a.	136	120	127	170	114	69
Janakpur	875	708	1,126	395	263	258	243	233	231	175	82
Khumaltar	237	304	249	288	257	186	163	213	217	241	200
Jiri	19	211	n.a.	n.a.	n.a.	155	171	158	225	146	30
Parwanipur - paddy	n.a.	n.a.	n.a.	n.a.	n.a.	245	670	782	770	767	659
Parwanipur - sugarcane	n.a.	n.a.	n.a.	n.a.	n.a.	214	211	190	254	142	141
Rampur - maize	n.a.	n.a.	n.a.	n.a.	n.a.	578	625	1,109	1,508	1,111	1,032
Bhairahwa - wheat	n.a.	n.a.	n.a.	n.a.	n.a.	378	430	526	978	411	789
Cotton research	n.a.	n.a.	n.a.	n.a.	n.a.	172	n.a.	180	198	n.a.	n.a.
Oilseed crop	n.a.	n.a.	n.a.	n.a.	n.a.	164	434	153	316	205	127
Cardamom development	n.a.	n.a.	n.a.	n.a.	112	67	75	133	181	82	89
Ginger development	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	19	18	29	28
Total	5,624	6,476	5,791	5,181	5,141	6,214	7,536	7,206	8,858	6,318	6,678

Sources: Nepal, Auditor General's Office, *Auditor General Annual Report*, various issues (Kathmandu: AGO, various years).

Notes: n.a. means data are not available or project was not yet in existence. Nepal's consumer price indexes (1972/73 = 100), used to convert current rupees expenditure into real expenditure, are as follows: 1970/71 = 88.8; 1971/72 = 90.0; 1972/73 = 100.0; 1973/74 = 114.6; 1974/75 = 134.0; 1975/76 = 141.1; 1976/77 = 141.5; 1977/78 = 155.9; 1978/79 = 161.1; 1979/80 = 177.6; 1980/81 = 201.4.

Table 42—Livestock development budget expenditures, 1970/71-1980/81

Project	1970/71	1971/72	1972/73	1973/74	1974/75	1975/76	1976/77	1977/78	1978/79	1979/80	1980/81
					(1972/73 Rs 1,000)						
Livestock development farm											
Tarhara	503	243	303	421	432	318	317	287	297	248	353
Rampur	267	372	355	387	346	303	285	244	n.a.	n.a.	n.a.
Pokhara	240	199	337	518	281	380	300	697	874	2,848	1,876
Nepalganj	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	88	8	94	20	18
Solukhumbu	n.a.	n.a.	n.a.	297	189	208	204	183	175	157	128
Khumal	1,639	1,124	857	538	586	340	405	391	435	360	376
Jiri	264	211	254	241	243	230	253	252	229	198	187
Disease investigation and parasite control											
Tripuraswar	n.a.	n.a.	n.a.	235	348	358	642	532	423	381	350
Sheep farm											
Chitlang	53	89	78	69	125	89	115	97	121	81	78
Karnali	515	222	343	n.a.	n.a.	n.a.	n.a.	155	159	162	234
Tibrikot	n.a.	n.a.	n.a.	277	221	161	173	n.a.	n.a.	n.a.	n.a.
Panchasayakhola	88	174	99	153	175	149	105	115	104	103	89
Pasture development											
Rasuwa	35	36	36	48	81	74	57	54	57	57	56
Khumal	26	35	74	n.a.	n.a.	40	57	51	109	59	49
Yak farm											
Dolpa	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	35	51	123	78	53
Goat farm											
Bandipur	n.a.	n.a.	n.a.	n.a.	n.a.	142	n.a.	125	165	111	131
Sheep and goat development	n.a.	n.a.	n.a.	29	101	418	23	133	131	100	n.a.
Central hatchery											
Balaju	248	83	69	93	87	71	82	81	99	91	84
Parwanipur	246	233	326	286	314	272	299	275	358	200	197
Khumal[a]	145	108	91	155	118	117	339	230	202	211	160
Brooder and hatchery farm											
Nepalganj	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	104	148	62	76	113
Total	4,269	3,129	3,222	3,747	3,647	3,670	3,883	4,109	4,217	5,541	4,532

Sources: Nepal, Auditor General's Office, *Auditor General Annual Report,* various issues (Kathmandu: AGO, various years).
Note: n.a. means data are not available or station was not yet in existence.
[a] Includes central hatcheries in Kathmandu and Jawalakhel.

Table 43—Horticultural farm budget expenditures, 1970/71-1980/81

Project	1970/71	1971/72	1972/73	1973/74	1974/75	1975/76	1976/77	1977/78	1978/79	1979/80	1980/81
						(1972/73 Rs 1,000)					
Horticultural farm											
Janakpur	69	70	53	57	67	141	90	72	89	82	79
Panchekhel	n.a.	n.a.	150	94	84	133	179	92	86	82	88
Yagyapuri	135	229	187	235	167	150	211	158	181	175	154
Trisuli	34	58	51	84	84	71	170	78	60	46	56
Tarhara	125	84	122	113	133	205	146	79	71	57	62
Parwanipur	116	67	87	113	70	92	96	92	94	67	69
Helambu	72	42	53	56	56	62	75	273	127	78	85
Dhunibesi	30	58	48	52	67	53	50	60	60	47	54
Sarlahi	n.a.	n.a.	n.a.	n.a.	455	712	452	454	611	364	378
Kirtipur	169	201	274	257	288	269	210	216	308	207	200
Daman	75	124	135	155	143	167	143	142	199	115	114
Solukhumbu	n.a.	n.a.	n.a.	n.a.	n.a.	71	n.a.	65	137	66	154
Baitadi	44	77	64	54	138	88	101	83	87	90	80
Humla	n.a.	30	69	66	60	63	49	62	101	64	59
Jumla	21	20	44	184	171	81	135	143	173	131	92
Rasuwa	36	32	63	89	131	102	89	82	85	73	51
Dailekh	n.a.	n.a.	n.a.	11	17	28	43	262	142	87	144
Nepalganj	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	94	56	53	55
Pokhara	105	133	218	357	540	176	251	194	274	226	172
Godowari	51	180	160	157	169	159	186	214	238	212	191
Jiri	n.a.	n.a.	72	157	188	30	44	53	45	44	40
Kakani	75	101	94	188	146	137	231	173	162	226	149
Mustang	76	n.a.	110	68	161	509	549	428	392	369	320
Pulpa	44	58	47	61	74	216	140	75	88	64	59
Dhankuta	135	160	146	288	396	353	494	472	388	329	300
Potato											
Khumal	215	265	151	120	132	206	285	361	128	235	117
Potato nucleus farm											
Jiri	n.a.	n.a.	n.a.	n.a.	n.a.	60	121	144	55	38	38
Vegetable development and seed production											
Khumal	n.a.	n.a.	200	329	190	315	199	226	188	127	130
Rukum	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	37	88	124	69
Total	1,627	1,989	2,598	3,345	4,127	4,649	4,739	4,884	4,713	3,878	3,559

Sources: Nepal, Auditor General's Office, *Auditor General Annual Report*, various issues (Kathmandu: AGO, various years).
Note: n.a. means data are not available or station was not yet in existence.

Table 44—Fisheries development budget expenditures, 1970/71-1980/81

Project	1970/71	1971/72	1972/73	1973/74	1974/75	1975/76	1976/77	1977/78	1978/79	1979/80	1980/81
	(1972/73 Rs 1,000)										
Fisheries development center											
Tarhara	55	76	63	72	59	65	77	72	65	36	49
Pokhara	103	105	97	103	97	911	500	260	237	209	243
Bhairahwa	120	80	90	72	80	187	379	337	369	237	239
Kailali	n.a.	n.a.	n.a.	n.a.	n.a.	61	196	162	213	259	129
Trisuli	330	185	64	50	60	115	81	53	98	49	55
Janakpur	150	152	121	215	213	177	155	115	160	165	135
Godawari	117	77	55	103	149	107	117	98	98	78	83
Parwanipur	90	58	71	38	58	94	87	74	56	63	64
Fatepur	n.a.	96	113	219	151	298	78	61	102	77	59
Hatauda	267	145	226	177	182	173	193	192	192	188	232
Total	1,232	974	900	1,049	1,049	2,188	1,863	1,424	1,590	1,361	1,288

Sources: Nepal, Auditor General's Office, *Auditor General Annual Report*, various issues (Kathmandu: AGO, various years).
Note: n.a. means data are not available or project was not in existence.

Table 45—Food and agricultural input research budget expenditures, 1970/71-1980/81

Project	1970/71	1971/72	1972/73	1973/74	1974/75	1975/76	1976/77	1977/78	1978/79	1979/80	1980/81
	(1972/73 Rs 1,000)										
Food research projects											
Food research	446	292	543	121	139	142	203	190	386	324	282
Quality control	n.a.	n.a.	n.a.	246	169	212	295	295	277	247	269
Food testing in Hatauda	110	41	120	336	131	132	136	124	80	66	81
Nutritional research	n.a.	200	251	479	224	326	99	196	151	154	151
Total	556	533	914	1,182	663	812	733	805	894	791	783
Input research projects											
Agricultural engineering	456	592	296	409	306	240	304	334	412	420	238
Soil section	422	400	380	643	472	375	454	486	439	354	300
Total	878	992	676	1,052	778	615	758	820	851	774	538

Sources: Nepal, Auditor General's Office, *Auditor General Annual Report*, various issues (Kathmandu: AGO, various years).
Note: n.a. means data are not available or project was not in existence.

Table 46—Socioeconomic and marketing research budget expenditures, 1975/76-1980/81

Project	1975/76	1976/77	1977/78	1978/79	1979/80	1980/81
			(1972/73 Rs 1,000)			
Food, agricultural, and marketing services	164	202	227	225	195	188
Agricultural marketing research and development	117	124	125	140	131	164
Food situation analysis	31	48	60	52	54	50
Agricultural price analysis and marketing extension	71	93	118	127	87	83
Special studies economic analysis	161	187	247	148	221	219
Total	544	654	777	692	688	704

Sources: Nepal, Auditor General's Office, *Auditor General Annual Report*, various issues (Kathmandu: AGO, various years).

Note: Socioeconomic and marketing research expenditures, 1975/76-1980/81, annual growth rate = 5.31 percent (t-statistic = 1.79).

Table 47—Classification of budget expenditures

Budget Code	Type of Expenditure
1	Salary and wages
2	Allowances
3	Travel allowance and daily allowance
4	Services: printing and binding, postage, telephone, telex, bank service charges, advertising, transportation and freight charges for moving property
5	Rent
6	Repair and maintenance
7	Expendable goods (with life less than one year)
7.1	Office stationery
7.2	Books, newspapers, and magazines
7.3	Fuel
7.4	Clothes and foodgrains for junior staff
7.5	Other expendable goods
8	Grants-in-aid, contributions, and rewards
9	Unforeseen
10	Durable goods (with life less than one year)
10.1	Furniture
10.2	Transport devices
10.3	Tools and machinery
11	Purchase of land and buildings
11.1	Purchase of land
11.2	Purchase of buildings
12	Construction and improvements
12.1	Building construction and improvements
12.2	Other construction and improvements

Source: Nepal, Ministry of Finance, *Income-Expenditure Estimated Budget, 1982/83* (Kathmandu: MOF, 1982).

Table 48—Trained personnel in agriculture, by institution, 1983

Institution	Ph.D.	M.S.	B.S. or Equivalent	Total
Ministry of Agriculture Secretariat	5	25	0	30
Department of Agriculture	9	137	400	546
Department of Livestock and Animal Health	3	26	91	120
Department of Food and Agricultural Marketing Services	4	32	3	39
Central Food Research Laboratory	2	30	0	32
Agriculture Development Bank	1	16	53	70
Agriculture Inputs Corporation	0	4	21	25
Agricultural Projects Services Centre	5	70	2	77
Institute of Agriculture and Animal Science	5	63	20	88
Dairy Development Corporation	0	11	14	25
Total	34	414	604	1,052

Source: A survey of personnel in agriculture by the author, 1983.

Table 49—Trained personnel in the Ministry of Agriculture and its parastatals, by discipline, 1983

Discipline	Ph.D	M.S.	B.S. or Equivalent	Total
Agronomy	3	23	55	81
Botany	3	16	10	29
Horticulture	1	25	40	66
Animal husbandry	1	13	37	51
Veterinary science	2	15	55	72
Agricultural economics	9	104	0	113
Agricultural extension	1	29	100	130
Rural sociology	0	5	0	5
Entomology	2	14	7	23
Plant pathology	1	15	21	37
Soil science	0	14	15	29
Fisheries	0	14	8	22
Agricultural engineering	0	11	27	38
Agricultural statistics and mathematics	2	17	3	22
Food technology	0	13	0	13
Nutrition	2	3	0	5
Business administration	0	4	0	4
Geography	1	0	0	1
Chemistry	1	10	6	17
Home science	0	2	1	3
General agriculture	0	0	188	188
Dairy technology	0	4	11	15
Total	29	351	584	964

Source: A survey of personnel in agriculture by the author, 1983.

APPENDIX 2: METHODOLOGY FOR DETERMINING GROWTH RATES AND DECOMPOSITION OF GROWTH TRENDS

Growth Rates

In order to compute annual growth rates, the exponential curve $Y = ab^t$, which represents a trend with constant rate of increase or decrease, is estimated. In logarithmic form it becomes

$$\log Y = \log a + t \log b,$$

where y = the value of the variable in year t, and t = time; 1970/71 = 1, 1971/72 = 2 . . . . Anti-log of log b gives the value of b and the growth rate $G = (b - 1) \times 100$, expressed in percentage.

Decomposition of Growth Trends

The decomposition of agricultural growth trends was analyzed employing multiplicative schemes developed by Minhas:

$$A_t \sum_c a_{ct} Y_{ct} P_c / A_0 \sum_c a_{c0} Y_{c0} P_c = (A_t/A_0)(\sum_c a_{c0} Y_{ct} P_c / \sum_c a_{c0} Y_{c0} P_c)(\sum_c a_{ct} Y_{c0} P_c / \sum_c a_{c0} Y_{c0} P_c)$$
$$(\sum_c a_{ct} Y_{ct} P_c / \sum_c a_{ct} Y_{c0} P_c \times \sum_c a_{c0} Y_{c0} P_c / \sum_c a_{c0} Y_{ct} P_c),$$

where

A_t = gross cropped area during period t,

a_{ct} = (A_{ct}/A_t) = proportion of area under crop c (A_{ct}) to the gross cropped area during period t,

Y_{ct} = physical output per hectare of crop c during period t, and

P_c = the constant price weights (1975/76) assigned to each crop.

This formulation expresses the index number of output as a multiple, respectively, of the index number of area, change in crop yields, change in cropping patterns, and a residual component that is the interaction between cropping pattern and yield components.

Fitting an exponential time-trend to each series of index numbers produces an additive scheme for growth,

$$G = G_A + G_Y + G_a + G_{ay},$$

where

G = growth rates of gross agricultural output,

G_A = growth rates of gross cropped area,

G_Y = growth rates of contribution of the yield effect,

G_a = growth rates of contribution of the cropping pattern effect, and

G_{ay} = residual components, such as growth rates of contribution of interaction between cropping pattern and yield components.

The residual component, G_{ay}, is obtained by subtracting $(G_A + G_Y + G_a)$ from G.

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